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ABSTRACT

This document contains the final report of the National Center for Productivity and Quality of Working Life, whose primary functions are to make the United States aware of the benefits of productivity growth and to encourage initiatives that will result in better productivity performance. Divided into six major sections, this report reviews the Center's activities and attempts to place these activities into the context of the Nation's progress in productivity relative to economic and social goals. Section 1 points out the need for a national policy explicitly directed toward improving productivity. The second section emphasizes the contribution productivity growth can make to solving some national problems and to achieving some long term goals. The third section details the recent deceleration in the rate at which our productivity is improving. The next two sections outline, on a national basis and for specific sectors, what has been, is being, and needs to be done to increase productive efficiency. The sixth section sets forth the Center's recommendations for actions, both public and private, which would raise the nation's rate of productivity growth. Appended materials include an annotated listing of the Center's publications; listings of Center-sponsored studies, reports, articles, and other activities; a listing of productivity and quality of working life centers (see also CE 019 154); and a brief summary of some of the productivity-related projects of other federal agencies. (BM)

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PRODUCTIVITY
in the
CHANGING WORLD OF THE 1980's

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The Final Report of the
NATIONAL CENTER FOR PRODUCTIVITY
and
QUALITY OF WORKING LIFE
1978

CE 019 152

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This document is required by Title II, Section 206, of Public Law 94-136, effective November 28, 1975, when the Center was established. The present report covers the period from October 1, 1977, to September 30, 1978.

National Center for Productivity and Quality of Working Life

September 1, 1978

TO THE PRESIDENT AND THE CONGRESS

I have the honor to transmit to you the final report of the National Center for Productivity and Quality of Working Life.

The expiration of the Center's mandate marks the end of Chapter One in the much needed effort to understand our Nation's productivity problems and to achieve consensus about how best to solve them. The Center's creation, in November of 1975, represented a Federal commitment to the idea that supporting industry initiatives to increase productive efficiency could improve the country's economic health; this idea is no less valid today.

Productivity growth is an important enabling factor in achieving our stated national goals. Reducing inflationary pressures, raising living standards, making U.S. goods competitive on world markets, protecting the quality of the environment, and supporting our growing population of retired people are some of the tasks we have set for ourselves. If we are to accomplish all these goals in the face of increasing scarcities of energy and raw materials, we must use what we have with greater efficiency and effectiveness.

Traditionally, we have assumed that productivity will take care of itself in some way. Unfortunately, the U.S. record during the past decade provides little cause for optimism for continuing that assumption. The present rate of U.S. productivity improvement is lagging our own historical performance and the performance of all other industrial nations.

It appears that the American people are now in need of a set of policies supportive of productivity growth. Management, labor, government and the public must consider not only how to share the benefits of a healthy, expanding economy but also how to sustain our economic health. This challenging task requires the commitment of all national leaders.

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Productivity growth in the U.S. can be accelerated. Balanced economic growth, with rising output and employment, would provide conditions which lead naturally to improvements in productivity. However, our current economic circumstances indicate a need for a more conscious effort, vigorously pursued, to enhance technological innovation, to stimulate capital investment and human resources development, and to encourage labor-management and business-government cooperation. Because practical techniques for improving productivity are largely industry or company specific, these broad measures should be complemented by programs to support, where needed, private sector initiatives to increase productivity.

One of the Center's primary functions has been to create a greater awareness at every level--in the boardroom, in the union local, in the Congress, and in the Executive Agencies--of the vital need to move ahead, together, on productivity problems and policies. In addition the Center has, as an objective and neutral agent, helped traditional adversaries within industries find common interests, identify mutual problems, and seek cooperative solutions. The Federal Government, through the Center, has not attempted to prescribe specific remedies for individual productivity problems on the premise that Government-imposed solutions are not as effective as those developed and implemented by the individuals and groups directly affected.

Those of us associated with the Center are justifiably proud of what it has achieved. It must be noted that those achievements have been made possible by the leadership and counsel of business, labor, academic, and professional representatives from all over the Country. We have also drawn on their experiences, and that of other countries, in an effort to find common and consistent approaches toward the establishment of a national productivity policy reflected in this report. The Nation is deeply indebted to the many individuals and organizations who have contributed to this endeavor.

Respectfully

George H. Kuper
Executive Director

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FOREWORD

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The present report is the Center's third and final one. As such, it is more comprehensive than the two previous reports. It not only reviews the Center's activities during the fiscal year 1978, it also summarizes the Center's activities during the 3 years of its existence. In addition, it attempts to place the Center's activities into the context of the Nation's progress in productivity and to place this progress into the context of our economic and social goals.

The report has several major sections. The first points out the need for a national policy explicitly directed toward improving productivity. The second emphasizes the contribution productivity growth can make to solving some of our Nation's problems and to achieving some of our long-term goals. The third section details the recent deceleration in the rate at which our productivity is improving. The next two sections outline, on a national basis and for specific sectors, what has been, is being, and needs to be done to increase productive efficiency. The sixth section sets forth the Center's recommendations for actions, both public and and private, which would raise the Nation's rate of productivity growth. The appendix materials in this report are also more comprehensive than in previous ones. They include a complete listing of the Center's publications and of Center-sponsored studies, reports, articles, and other activities, a listing of productivity and quality of working life centers, as well as a brief summary of some of the productivity-related projects of other Federal agencies.

A NOTE ON THE MEANING AND MEASUREMENT OF PRODUCTIVITY

The concept of productivity is deceptively simple: it refers to productive efficiency. Productivity measures the relationship between the amount of goods or services produced (output) and the quantities of labor, capital, and material resources (inputs) used to produce that output. In order to compare productivity over time or among different productive entities, it is usually stated as a ratio of output to input. When the same amount of input produces more goods or services in one instance than in another, or when the same amount of output can be produced with less input, we say that productivity is higher or has increased.

In practice, measuring changes in productivity is not so simple. The quality of output, for example, may change over time or vary among producers. Quantifying public service outputs is a particular problem. Few industries or plants produce only one product; sometimes a single process will produce more than one product. Aggregating these products into a single measure of output requires choosing a weighting system to represent their importance in a unit of output.

Input, too, is difficult to measure properly. Output results from combining many inputs. Nevertheless, a productivity ratio usually relates output to only a single input. When a productivity ratio based on a single input changes, the tacit assumption is that the change is attributable to that input. In reality, the change has been influenced by all the variables in an interrelated economic system: production techniques and capital equipment, workforce skills, managerial ability, the rate of capacity utilization, the scale of operations, materials flow, product mix, the state of labor-management relations, the quality of the work environment, and a multitude of other factors. The relative importance of these influences will vary from country to country, from sector to sector, from organization to organization, as well as over time.

Many different productivity ratios can be calculated: output per labor hour, output per BTU of energy, farm yield per acre of land, sales per square or cubic foot of space, output per dollar of capital assets, or any of a host of other combinations. The choice of ratio will depend partly on the purpose for calculating it and partly on the availability of measurable data.

The productivity measure used in this report relates output in physical units or in constant dollars to hours spent at work, or labor time. For the private business sector, labor input includes the time of employees, supervisors, foremen, managers, and self-employed persons. Statistics on output per hour are published regularly for the private business sector and for major industries by the U.S. Bureau of Labor Statistics.

It should be kept in mind that output per hour simply indicates how much labor time is associated with a given volume of output. Although worker skill and effort clearly are important sources of productivity improvement, they are not the only sources. Nevertheless, this concept of productivity is the one most commonly used; perhaps because it is people that benefit from higher productivity, it is of particular interest to highlight their contribution to it.

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NEEDED: A NATIONAL PROGRAM TO IMPROVE PRODUCTIVITY

AMERICANS, THROUGHOUT HISTORY, HAVE ENJOYED a steadily rising standard of living. The economy has expanded, new jobs have been created, choices have broadened, and rewards have increased. The average American today consumes greater amounts and varieties of goods and services, performs less backbreaking work, and has more leisure time than the generations before.

This better life was made possible by sustained productivity improvement--a continuing ability to produce more in less time and with fewer resources. Institutional accommodations, such as collective bargaining and a broad range of social legislation, assure that the gains of productivity growth are shared widely and equitably.

Economic and social developments during the past decade have made it clearer than ever that the processes of productivity growth are not automatic. If the future is to measure up to the past, the factors that sustain growth must be strengthened. The growth rate of productivity has been slowed down by the burdens of high rates of inflation, low capacity utilization, a sluggish rate of investment, and a declining rate of expenditure on research and development, and demographic and industrial shifts.

Events abroad have compounded our domestic economic problems. The revolution in energy prices and the burgeoning of multinational firms have intensified international competition for markets. Investment capital and advanced technology are more mobile now than in the past, and some of our trading partners have been able to improve their productivity at a much faster pace than the United States.

The Nation's ability to moderate inflation, reduce unemployment, sustain brisk economic growth, and extend past gains in the quality of life is threatened by the prospect of a low rate of productivity growth in the 1980's. Only if productivity improves at a faster rate than in the recent past can we afford a much higher standard of living for all, including the growing number of retired persons in our population.

Meeting these challenges will require strengthening all the underlying sources of productivity improvement. Our policies must be designed to improve the climate for technological innovation, to increase capital investment, and to encourage a business/government environment that is conducive to growth. A basic challenge is to find ways of effectively enhancing the security, participation, cooperation, and skills of the work force.

General measures need to be complemented by efforts in each industry to achieve specific opportunity targets. Because the importance of the various sources of growth differs among industries, the most effective policy agenda for each sector would be industry-specific, drawn up by those responsible for its execution in each industry.

Although many Federal agencies offer programs and activities that affect productivity, we have no truly national productivity policy, executed through actions which have productivity improvement as their direct goal. Given the importance of efficient production to our present and future economic progress, this is a serious vacuum indeed. The Center proposes an agenda for national action to fill this vacuum. The agenda suggests two types of Federal actions: those which are uniquely national in that only the Federal Government could carry them out, and those which will assist industry and local government efforts to improve their own productive efficiency.

This agenda, which is spelled out in detail in the final section of this report, proposes that the Federal Government should:

I. Exercise national leadership by:

- establishing a focal point for productivity improvement activities
- supporting National, State, and local nonprofit productivity centers

II. Assist industrywide efforts to improve productivity by:

- encouraging management-labor-government task forces on productivity improvement

- coordinating the needs of industry with existing Government programs

III. Encourage labor-management cooperation by:

- providing information, technical assistance, and training
- supporting communitywide labor-management councils
- supporting research on workplace problems
- endorsing cooperative approaches to problem solving and training third parties to assist these efforts
- applying labor-management cooperation in Government

IV. Encourage manpower planning by:

- providing information on the costs and benefits of private measures to cushion individual adjustments to technological change and productivity improvement
- providing technical assistance for employment stabilization planning
- coordinating private adjustment efforts with public ones
- encouraging programs to train technicians in new technologies

V. Foster technological innovation by:

- encouraging closer cooperation between engineering schools and industry
- facilitating the diffusion of new technologies
- requiring performance specifications in Government procurement
- encouraging the acquisition and use of advanced technologies from abroad

VI. Support increased capital formation by:

- allowing accelerated depreciation on investments in major innovative projects
- making the investment tax credit permanent
- encouraging small venture capital enterprises
- investigating the potential for employee stock ownership
- stimulating productivity improvement (and lower prices) in capital goods industries

VII. Reform the regulatory system by:

- eliminating or simplifying regulations, where appropriate
- investigating alternatives to regulation

- developing regulations in consultation with those affected
- achieving compliance through consultation rather than threat
- coordinating regulatory requirements

VIII. Improve public sector management by:

- using the Federal grant system to reward good management
- expanding programs to improve managerial skills
- encouraging capital budgeting
- supporting labor-management cooperation

IX. Improve productivity measurement by:

- developing a family of measures based on different input concepts
- measuring service industry productivity
- expanding international data
- encouraging productivity measurement at the plant level and interfirm comparisons of productivity

X. Create awareness of the importance of productivity through the educational system, the media, professional societies, trade associations, business, and unions.

These general and specific policy issues should be considered within the context of efforts to achieve the national objectives of full employment and inflation control. Substantial productivity improvements can sustain higher rates of real hourly compensation with little (or no) increase in unit labor costs; real rewards could increase while prices are contained. Unless production increases briskly, however, rising productivity could also lower our employment potential. If output grows sluggishly, or not at all, increasing our ability to produce more with fewer people could reduce the number of available jobs. At the same time, however, rapid gains in productivity are the mainstay of the rise in real incomes that would induce output to grow.

The pursuit of national economic goals often involves conflicts among the various interest groups in our society. Trade-offs and compromises are necessary to balance competing claims for a share of economic output. Productivity gains, by enlarging the size of that output, allow everyone to have a larger share and help to reconcile conflicting objectives: higher wages and profits without higher prices, more government services without higher taxes, and economic growth without sacrificing consumption and environmental standards.

PURSUING OUR NATIONAL GOALS

A NATIONAL COMMITMENT AND A COORDINATED PROGRAM to improve our productivity performance is vital to the economic, social, and political health of America. Improved productive efficiency could contribute to

- sustaining our economic growth
- raising living standards
- easing inflationary pressures
- improving our ability to compete in world markets
- achieving a better quality of life

>> ECONOMIC GROWTH <<

Economic growth has meant a better life. The average American is offered more goods and services in greater variety than ever before. The wider range of consumption choices is not reflected in our national income statistics, but it is an important aspect of the quality of life in the United States.

Potentially, our growth rate could begin to decline in the near future. The U.S. birth rate has dwindled steadily since 1960, and as a result, the work force is expected to increase only about 1 percent a year in the 1980's. Unless productivity improves rapidly, output cannot expand at its historic trend rate of 4 percent a year. If potential economic growth is to maintain this pace, output per hour must increase at a rate close to 3 percent a year.

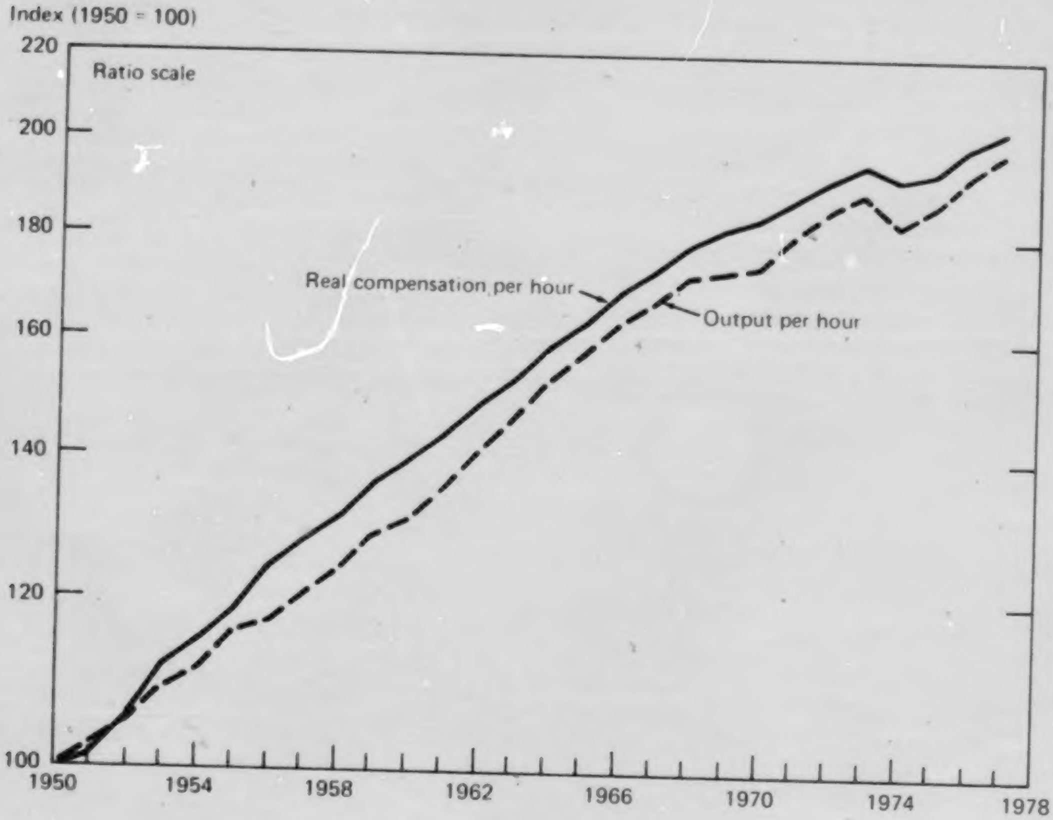
>> A HIGHER STANDARD OF LIVING <<

The long-term expansion of the economy, accompanied by improved productivity, has enabled the United States consistently to raise its average level of living. In 1977, the real output of the Nation's private business sector was 2-1/2 times larger than in 1947. Only a small fraction of this increase was achieved because people worked more hours; about three-fourths was made possible by using work hours more efficiently.

During the 30-year postwar period, hours worked per person in the total population declined, while real output per person--a rough measure of the average level of living--advanced. Thus, the entire growth in real output per person reflects an improvement in real output per hour--productivity. As Chart 1 indicates, real hourly compensation also has improved at approximately the same rate as productivity.

Chart 1

Output Per Hour and Real Compensation Per Hour, Private Business Sector, 1950-77



Source: U.S. Department of Labor, Bureau of Labor Statistics

>> INFLATION CONTROL <<

Price inflation is influenced by many factors: monetary and fiscal policies of government, energy prices, regulatory programs, the effect of weather conditions on food production, and many others. Because productivity directly affects the input costs that push prices upward, there is wide agreement that faster productivity growth could be a major contributor to the effort to moderate and control inflation.

One of the many complex factors underlying the inflation of the past decade has been the failure of productivity gains to match the rise in hourly compensation. Hourly compensation, which includes fringe benefits as well as wages and salaries, increased at an average annual rate of 7.8 percent between 1967 and 1977; this was substantially faster than output per hour improved. The result has been a 6.1 percent annual increase in unit labor cost, although real hourly compensation increased only 1.5 percent a year. During this same period, the Consumer Price Index has climbed at an average rate of 6.3 percent a year.

The experience of the early 1960's demonstrated that high productivity growth can be a stabilizing influence on prices. Table 1 compares this experience with that of the last decade.

Table 1

Selected Data for Private Business Sector, 1960-67 and 1967-77

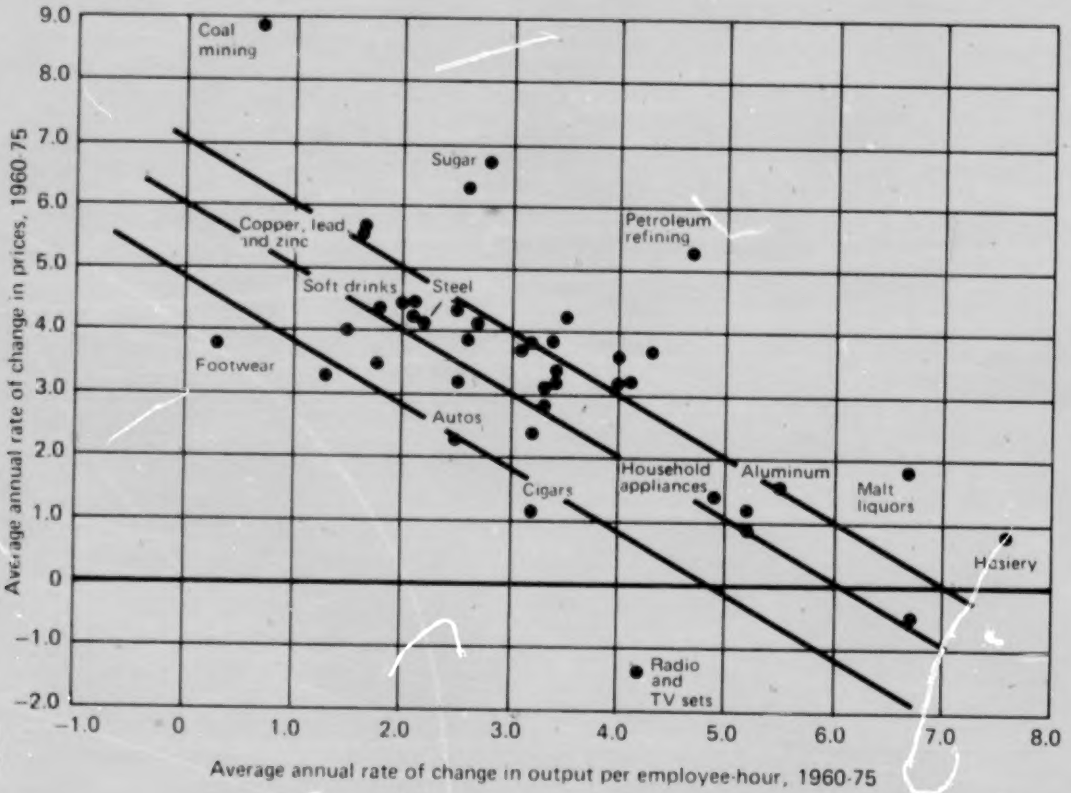
Item	Average annual percent change	
	1960-67	1967-77
Output per hour	3.7	1.6
Compensation per hour	4.9	7.8
Unit labor cost	1.1	6.1
Real hourly compensation	3.2	1.5
Consumer Price Index	1.7	6.3

Source: U.S. Department of Labor, Bureau of Labor Statistics

During the 1960-67 period, when productivity was advancing at the substantial rate of 3.7 percent a year, hourly compensation was rising 4.9 percent a year. As a result, unit labor cost was fairly stable, and prices followed suit--consumer prices increased only 1.7 percent a year. Real hourly compensation increased at a rate of 3.2 percent, which bolstered the Nation's ability to purchase more goods and services. Because output was expanding more rapidly than productivity was improving, new jobs were created, and unemployment gradually fell below 5 percent.

The close relationship between productivity growth and long-term price stability is evident in Chart 2.

Chart 2
Correlation Between the Average Rates of Change in Prices and Productivity, Selected Industries, 1960-75



Source: U.S. Department of Labor, Bureau of Labor Statistics

During the 1960-75 period, most industries with above-average productivity growth, either voluntarily or under the pressure of competition did not raise their prices as much as industries with below-average productivity growth.

>> INTERNATIONAL COMPETITIVENESS <<

Historically, this country's higher level of productivity, for the most part, has offset our higher wage costs relative to other countries. American industry was able to maintain its competitive position in the expanding world markets of the postwar period, and domestic jobs were conserved without resorting to restrictive trade policies.

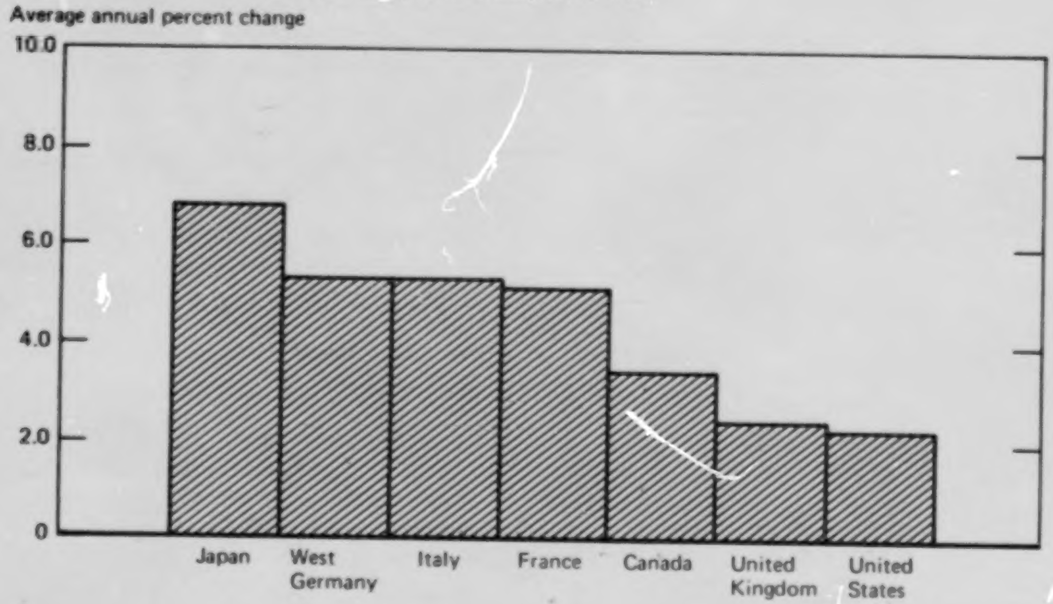
A strong competitive capacity is even more urgent today because of the need to expand exports to offset the Nation's increasing dependence on imported oil. The growing reliance abroad on protectionism makes controlling export prices particularly important. Competitive export prices and high wages can be made compatible by stepping up productivity growth at home.

At present, the prospects for American trade are clouded by rapid increases in manufacturing productivity in Japan, West Germany, and many other nations with whom we trade. The average level of productivity in the United States is still higher than that in other industrial countries (see Chart 3), but during the 1960-77 period, productivity growth in U.S. manufacturing has been lagging. Our productivity advantage is narrowing; in some key industries, it has been eliminated with respect to Japan.

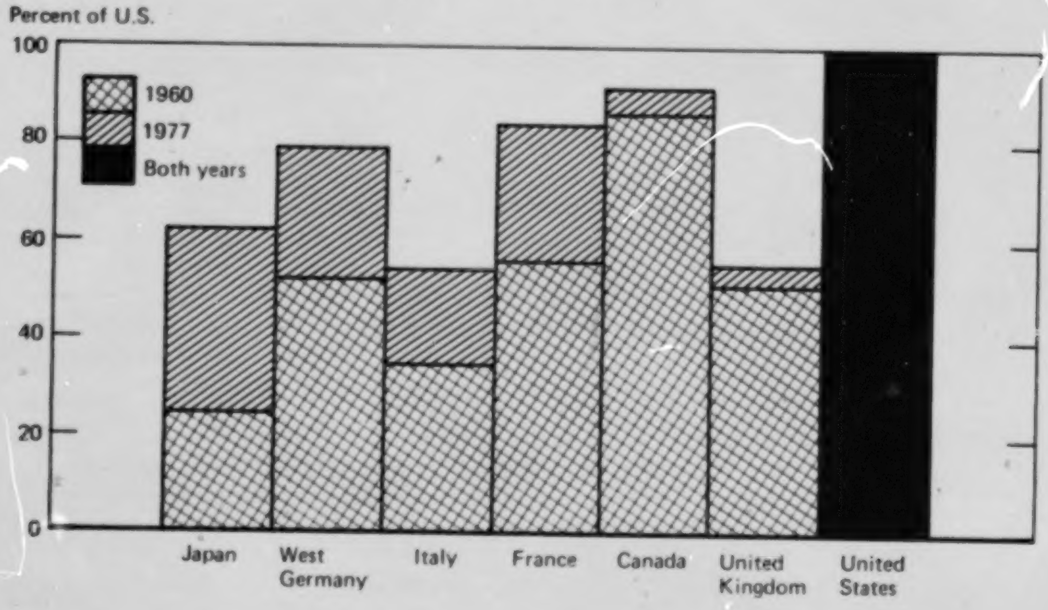
The trade advantage other countries gained because their manufacturing productivity has increased faster than the United States' was diminished between 1970 and 1975, when their hourly compensation rates and unit labor costs also increased more rapidly. But, as Table 2 indicates, in 1976 and 1977, unit labor costs in manufacturing (on a national currency basis) rose more slowly in West Germany and Japan than in the United States, and these countries have regained the competitive advantage of faster productivity growth.

Now, our exports are facing new competitive pressures, and imports of shoes, textiles, consumer electronics, and clothing are taking over an even larger share of our domestic market. Faster productivity improvement could help American firms increase their markets and maintain manufacturing employment, but only if fair competition prevails in foreign markets and access is secured for U.S. exports. Currency devaluation and protectionist trade policies may stem foreign competition--but only as short-term palliatives.

Chart 3
Output Per Hour in Manufacturing, Average Annual Percent Change in Selected Industrial Counties, 1960-77



Comparative Real Gross Domestic Product Per Employed Civilian in Selected Industrial Countries, 1960 and 1977



Source: U.S. Department of Labor, Bureau of Labor Statistics

Table 2

Productivity, Hourly Compensation, and Unit Labor Cost in Manufacturing, Selected Countries, 1970-75 and 1975-77

Item	United States	West Germany	Japan	France	United Kingdom
	Average Annual Percent Change				
Output per Hour					
1970-75	2.0	5.5	4.3	4.6	3.2
1975-77	3.7	6.2	9.5	6.5	.9
Compensation per Hour					
1970-75	7.9	13.5	20.3	15.0	17.8
1975-77	8.9	7.6	9.2	13.9	14.0
Unit Labor Cost					
1970-75					
National Currency	5.8	7.5	15.4	9.9	14.2
U.S. Dollars	5.8	17.3	20.7	15.8	12.5
1975-77					
National Currency	5.1	1.4	-0.3	6.9	13.0
U.S. Dollars	5.1	4.2	5.0	-0.2	.1

Source: U.S. Department of Labor, Bureau of Labor Statistics

>> A BETTER QUALITY OF LIFE <<

The partnership of rising productivity and economic growth can produce a social bonus that can be spent in many ways to enrich the lives of all.

Environmental Improvement

Material progress is sometimes associated with the loss of environmental amenities. Increased productive efficiency does contribute to material progress, but it is also a means of generating income which could be directed into controlling, and even reversing, environmental pollution, without sacrificing other economic goals.

Relief from Poverty

Unless productivity and economic growth increase, efforts to improve the lot of persons subsisting on poverty-level incomes depend on redistributing incomes--that is, by taking income from one group and transferring it to another. In an expanding economy, there is more for everyone. Productivity gains, equitably shared, could contribute to a climate of industrial and social peace.

Support for an Aging Population

Future productivity performance will have an important bearing on the Nation's ability to maintain, at above-minimum levels, the growing population of retirees. The postwar baby boom will be transformed early in the 21st century into a senior citizen boom. Further, as advances are made in health care, senior citizens will live to enjoy their retirement longer. As a result, the age composition of our population will change. The U.S. Department of Health, Education, and Welfare estimates that the present 6 to 1 ratio of active workers to retired persons will be halved by the year 2030. Steady increases in output per worker will be essential if the working population of the future is to support the nonworking aged, without reducing the living standards of either.

Nonmaterial Gains

As people meet their material wants more easily, they place greater value on leisure, education, health, and recreation. The American people have always used productivity gains, not only to increase per capita consumption of goods and services, but also to reduce the amount of time they spend at work. As productivity improves, work will absorb less of the year and less of a lifetime as well--more years can be spent in school and more in pensioned retirement.

REASONS FOR CONCERN

IN A LITTLE-NOTICED SENTENCE in the 1978 Economic Report of the President, the Council of Economic Advisors stated that the slowdown in productivity growth is "one of the most significant economic problems of recent years." Although this slowdown affects almost every major economic issue, policy makers have paid inadequate attention to it.

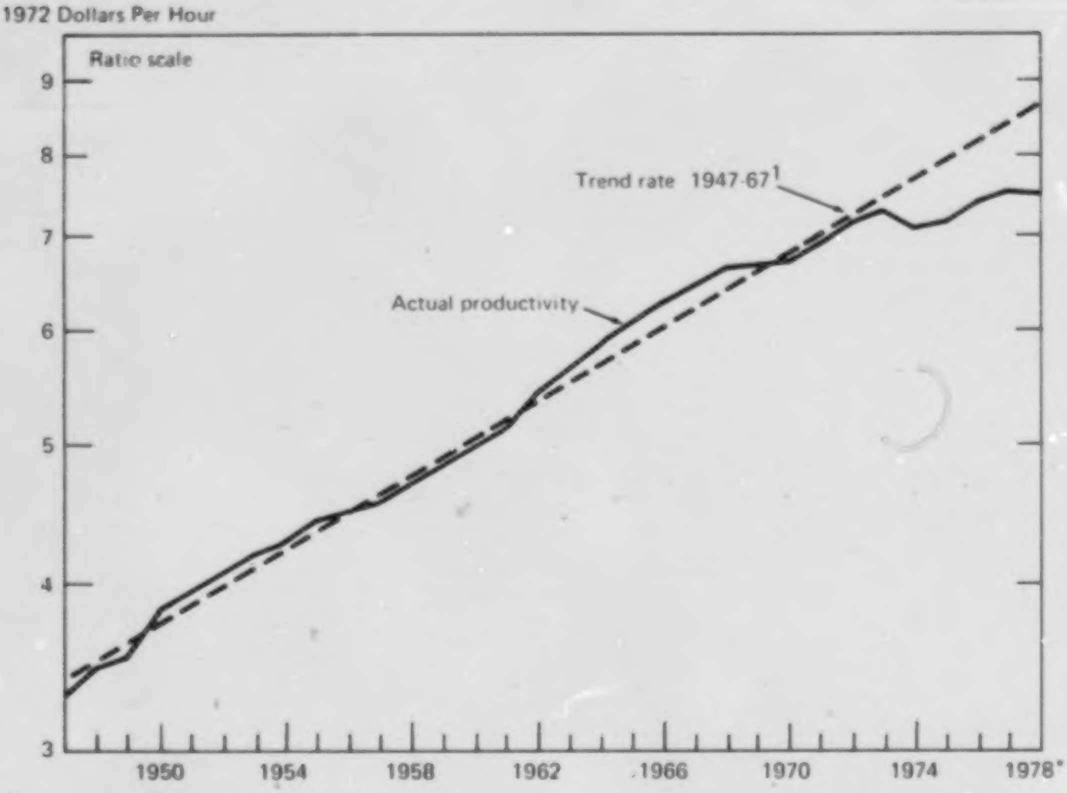
>> THE RECORD <<

The deceleration in productivity growth has been underway since the late 1960's. During the first 2 decades following World War II, output per hour in the private business sector increased at an average rate of 3.2 percent; during the most recent decade (1967-77), the rate of increase dropped by one-half, to 1.6 percent a year. Chart 4 compares annual productivity levels for the entire postwar period with the early-period trend in productivity growth.

Industrial Incidence

The slowdown in productivity growth was fairly pervasive throughout the economy. About two-thirds of the 62 industries for which the BLS reports data showed lower rates of productivity growth for the 1967-77 decade than for the previous two. As Table 3 shows, output per hour grew somewhat more slowly in the automobile, appliance, railroad, and telephone industries, and it grew at about half its former rate in petroleum refining and utilities.

Chart 4
Productivity in the Private Business Sector, 1947-78



[1] Growth rate of 3.2 percent per year

*2nd quarter

Source: U.S. Department of Labor, Bureau of Labor Statistics

The level of productivity in coal and iron mining actually declined during the 1967-77 period. After 2 decades of rapid improvement, output per hour in coal mining turned downward at a rate of almost 4 percent a year; productivity in iron mining declined only slightly, but this represents a reversal of its previous rate of growth. These changes are particularly significant because they raise the real cost of raw materials essential to other major industries.

Cyclical Fluctuations

The 1967-77 slowdown reflects, in part, the impact of two recessions and recoveries. Gains of more than 3 percent were recorded during the expansions of 1968, 1971, and 1975; gains were negligible in 1970, and a sharp decline occurred during the 1974 recession.

Table 3

Output per Employee Hour in Selected Industries, 1947-67 and 1967-77

Industry (in SIC order)	Average annual percent change	
	1947-67	1967-77
Iron Mining (usable ore)	3.9	-0.2
Coal Mining	6.5	-3.8
Bakery Products	2.1	1.5
Tobacco Products	3.6	1.7
Hosiery	5.0	9.1
Sawmills	3.5*	1.7
Paper, Paper Board, and Pulp Mills	5.8	3.3
Synthetic Fibers	4.1**	8.2
Petroleum Refining	6.0	3.0
Tires and Tubes	4.2	2.3
Footwear	1.8	0.3
Glass Containers	1.4	1.8
Steel	1.7	1.8
Metal Cars	2.5	2.2
Major Household Appliances	6.4*	4.5
Radio and Television Receiving Sets	5.8*	3.4
Motor Vehicles and Parts	4.5**	3.8
Railroads	4.8	2.8
Intercity Trucking	2.7***	3.1
Air Transportation	7.9	4.4
Telephone Communications	7.1****	5.8
Gas and Electric Utilities	7.2	3.0
Retail Food Stores	3.1*	0.0
Gasoline Service Stations	2.8*	4.5
Eating and Drinking Establishments	1.1*	0.5
Hotels and Motels	3.0*	0.9
Laundry and Cleaning Services	1.5	0.8

*1958-67, **1957-67, ***1954-67, ****1951-67

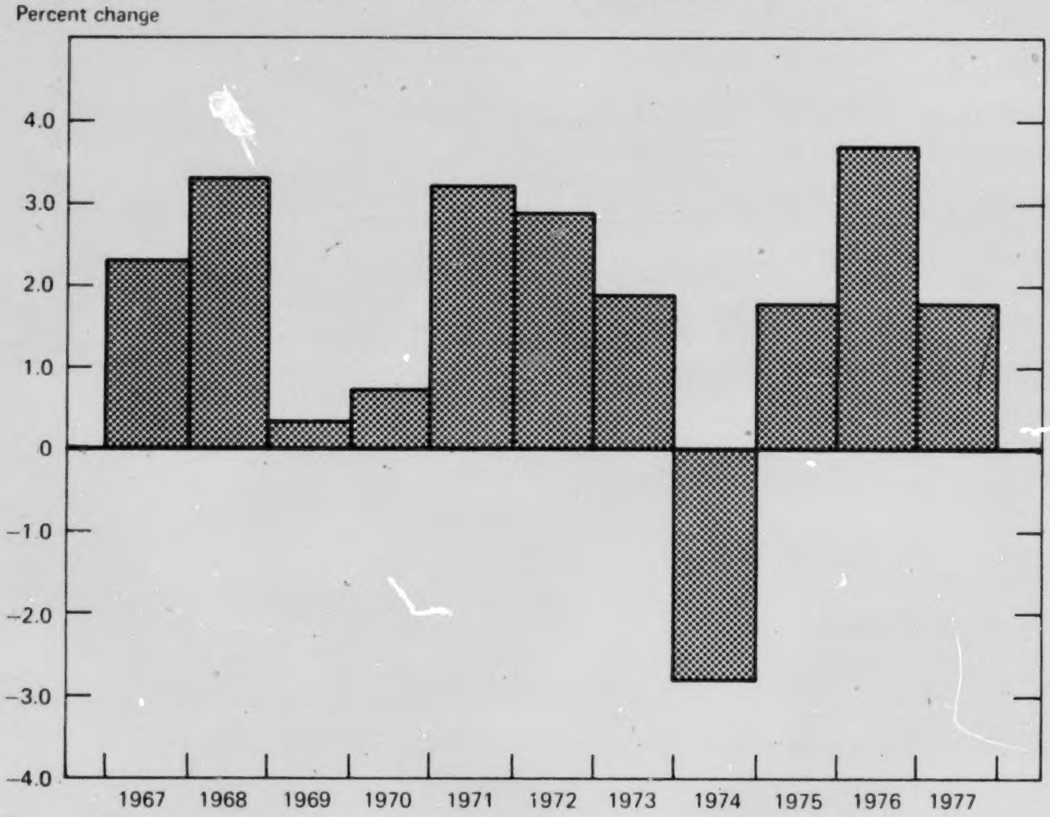
Source: U.S. Department of Labor, Bureau of Labor Statistics

Typically, productivity growth declines sharply in the first stages of a recession as output is cutback more rapidly than employment. As output increases during a post-recession expansion, the productivity ratio advances substantially, especially in the early stages of the expansion, when overhead labor is used more effectively. The rate of productivity growth then levels and, in the later stages of the expansion, declines as output approaches capacity and other constraints. Table 4 traces these changes through recent business cycles.

Productivity declined markedly throughout the most recent recession period, and, so far, the expansion has not produced as rapid gains in productivity as have previous expansions. Furthermore, the productivity improvement rate is already weakening; it was only 1.7 percent in 1977 compared to the 3.7 percent increase in 1976 (see Chart 5). Although we are believed to be still in the midst of an expansion, productivity growth in 1978 may be at an even lower rate.

Chart 5

Year-to-Year Percent Change in Output Per Hour, Private Business Sector, 1967-77



Source: U.S. Department of Labor, Bureau of Labor Statistics

Table 4

Average Annual Rates of Change in Output per Hour During Business Cycle Expansions and Contractions, Private Business Sector

Business Cycle					
Expansion			Contraction		
Period (Q = Quarter)	Rates of Change (%)		Period (Q = quarter)	Rates of Change (%)	
	First half	Second half		First half	Second Half
4th Q '45-4th Q '48		4.8	4th Q '48-4th Q '49	-2.5	5.1
4th Q '49-3rd Q '53	6.0	3.1	3rd Q '53-2nd Q '54	-1.0	1.0
2nd Q '54-3rd Q '57	3.5	2.0	3rd Q '57-2nd Q '58	3.5	3.5
2nd Q '58-2nd Q '60	4.9	1.3	2nd Q '60-1st Q '61	-1.5	2.9
1st Q '61-4th Q '69	4.5	2.1	4th Q '69-4th Q '70	1.6	2.5
4th Q '70-4th Q '73	3.5	1.2	4th Q '73-1st Q '75	-4.8	-1.5
1st Q '75-4th Q '77*	3.4				

*Not yet terminated.

Note: Cycle dates are according to the National Bureau of Economic Research revised chronology and are terminal dates. The rates of change are on an annual basis. The original data on output per hour are from the U.S. Department of Labor, Bureau of Labor Statistics.

>> WHY THE SLOWDOWN? <<

Economists, attempting to explain the slowdown of productivity improvement during the past decade and to predict the future, tend to emphasize three measurable long-term factors:

- the lower rate of growth of capital stocks per worker
- the increasing proportion of inexperienced employees in the labor force
- adverse changes in the industrial composition of employment

These are not the only factors that may have depressed productivity improvement. Others include the sharp increase in energy prices, the slower pace of technological progress, changing attitudes about work and leisure, popular misapprehensions about the social benefits of science and its applications, increasing Government involvement in the economy, and the ease of passing cost increases along to the consumer during a period of prolonged inflation. The effects of these complex factors are speculative and difficult to measure; nevertheless, they color the environment in which productivity gains are made.

Changes in the Capital-Labor Ratio

Output per hour is unquestionably enhanced by upgrading the plant and equipment that is used in production. The degree of enhancement appears to be lessening, however, in three respects:

--Although tangible capital stock appears to have increased more rapidly than the work force since 1947, some evidence points to a slower rate of increase in the capital-labor ratio (the ratio of the net stock of fixed business capital to total employee hours) since 1967 than during the 1947-67 period.

--Capital productivity may be becoming a weaker force in productivity improvement. The productivity of tangible capital stock (output per unit of capital input) has declined since 1967, following a period of gradual growth. This fact, and the slower growth of the capital-labor ratio are widely believed to account for much of the sharp reduction in the labor productivity growth rate during the past decade.

--Capital-labor calculations may overstate the real value of plant and equipment used in production. Sharp increases in energy and materials prices, and stiffer pollution control, health, and safety requirements may have forced premature abandonment of some equipment and processes. This type of obsolescence may not be fully reflected in capital stock accounting.

The Impact of Industrial Shifts

The measurement of changes in output per hour is affected, not only by technological and related changes within the various industry sectors, but also by shifts of labor among more and less productive sectors of the private business economy. The most dramatic shift in the past has been that of millions of farmers and farm workers from agriculture, with its low level of output (in constant dollars) per hour, into the higher productivity industrial and service sectors. During the first 2 postwar decades, this rapid redistribution contributed an average of 0.5 percent a year to the productivity growth rate of the economy as a whole.

Recently, however, the industrialization process has been yielding smaller and smaller gains in measured private sector productivity. There are two reasons for this: (1) the gap between farm and nonfarm productivity levels has narrowed as agricultural production has been transformed by technology, and (2) the proportion of farmers in the work force is by now so low (4 percent) that the shift out of agriculture has virtually stopped.

Between 1966 and 1976, this shift effect amounted to only 0.1 percent a year. The BLS attributes about one-third of the retardation in the trend rate of productivity between 1947-66 and 1966-73 to the declining rate of migration out of agriculture. It is apparent that the shift of labor from farm to nonfarm sectors can no longer be counted on to bolster future productivity growth.

Another structural shift in employment that is cited as contributing to the recent slowdown in productivity improvement is the relative increase in importance of the service industries. These industries are commonly believed to have lower than average levels of labor productivity; however, measures of service outputs are less reliable than those for goods and could be biased downward. If this shift has had an effect on productivity growth, it has been a small one. The BLS estimates that this effect has accounted for less than 0.1 percent of the decline in overall productivity improvement.

Changes in Composition of the Labor Force

The profile of the labor force has changed considerably during the postwar years, particularly the last 10: there are relatively more young people and women and relatively fewer older men working today. The first babies of the postwar boom began in the mid-1960's to enter the labor force, and now its age structure is weighted toward youth. Young workers, because they have not yet developed the skill and experience of their elders, may not contribute as much as they someday will to the Nation's productivity. A variety of social changes--the women's movement, the high divorce rate, and family income pressures, among others--have brought large numbers of women into, or back into, the labor force. At present, women often are handicapped by inexperience and by lack of opportunity in the high-productivity jobs and industries. At the same time, the proportion of experienced, older men in the labor force has dwindled, partly because of early retirement.

Some of these demographic trends are expected to have a lesser impact on productivity after 1980. The labor force will "age" in reflection of the declining birth rate since 1960. The labor force participation rate of women is likely to level, and their productive abilities may be better employed as opportunity differences between the sexes narrow. As the composition of the labor force stabilizes, and as its growth rate diminishes, employers may be induced to adopt measures for training and motivating their employees; this should have a positive effect on productivity levels.

>> THE OUTLOOK FOR PRODUCTIVITY IMPROVEMENT <<

To the extent that it is possible to project the long-term course of productivity growth, the outlook is disquieting. The Center asked a panel of international authorities to assess the future of productivity during the next 10 years in the United States, Western Europe, and Japan. These experts project that, barring severe recession, productivity will improve at a faster rate than in the 1967-77 period but at a slower rate than in the previous 2 decades.

Although productivity growth among our trading partners in Western Europe and Japan could also be at slower rates than in the past, it is expected to be faster than in the United States. Output per employee-hour in Japan is expected to increase at an annual rate of 6 percent and in Western Europe at a rate of 4 percent a year.

The BLS projection for productivity growth in the United States is based on a balance among measurable influences on productivity growth:

On the Up Side

- An older, more experienced labor force
- An accelerating capital-labor ratio as the labor force grows more slowly

On the Down Side

- More investment to meet Government standards
- More investment in energy conservation and source conversion
- No further impact from the farm-nonfarm shift

The net result, according to the BLS, will be an annual productivity improvement rate of 2.4 percent during the 1975-80 period, and a rate of 2.7 percent during 1980-85. Other experts forecast an even lower rate of productivity growth--2.0 percent a year--during the next decade. These rates will be higher than the 1.6 percent growth rate of the decade just past, but they are still significantly below the 3.2 percent trend rate of the preceding 2 decades.

>> COMPARATIVE PERFORMANCE: JAPAN <<

Japan's economy, until recently, was relatively undeveloped and highly import dependent. But, in one generation, Japan has become the world's third largest industrial nation. Its productivity growth rate in manufacturing has been remarkable--6.8 percent a year between 1960 and 1977. This growth has been possible because of Japan's unique industrial culture; its ability to capture, finance, and apply new technologies; and its government-reinforced emphasis on maintaining a favorable balance-of-payments position. Japan's productivity improvement record is enviable but not necessarily reproducible in the United States. Nevertheless, because of its extraordinary economic performance during the last 25 years, the sources of Japan's growth merit special study.

Technological Improvement

The technological and managerial sources of Japan's growth are particularly important. Much of Japan's recent advancement is due to its acquisition of foreign technology through patent and license agreements and systematic efforts to obtain nonproprietary information. It has combined these purchases with active government support of research and development efforts that concentrate on commercial application and early economic payoff.

The research and development efforts of universities, government, and industry are closely linked to large-scale industrial ventures destined for commercial application. Considerable support is given to new manufacturing technologies, such as automated machinery, which drastically reduce production costs. Recently, a 7-year program was launched to introduce advanced automation to companies too small to develop it alone.

Some Japanese industries have been rebuilt several times since the war and incorporate the most modern technology. The steel industry is a prime example. With about 80 percent of its 1975 steel tonnage produced in basic oxygen furnaces, Japan has a technological edge in steel production. Japanese labor productivity in steelmaking caught up with that of the United States in 1974 and surpassed it by 1976. This higher level of productivity has helped Japan's steel producers to compete successfully in world markets.

Capital Investment

The Japanese allocate an impressive share of their resources to capital investment. Between 1960 and 1975, Japan invested 29 percent of its gross domestic product in new plant and equipment, compared to West Germany's 22 percent, France's 20 percent, Sweden's 19 percent, and the United States' 15 percent. Japan also has substantially increased the stock of fixed capital per worker, although in 1971 this ratio was still only 44 percent of the U.S. level and 57 percent of the West German level (see Chart 6). Japanese industry relies more heavily on debt financing of its capital investment than on equity and retained earnings. This policy encourages reducing prices when demand slackens in order to maintain high rates of capacity utilization.

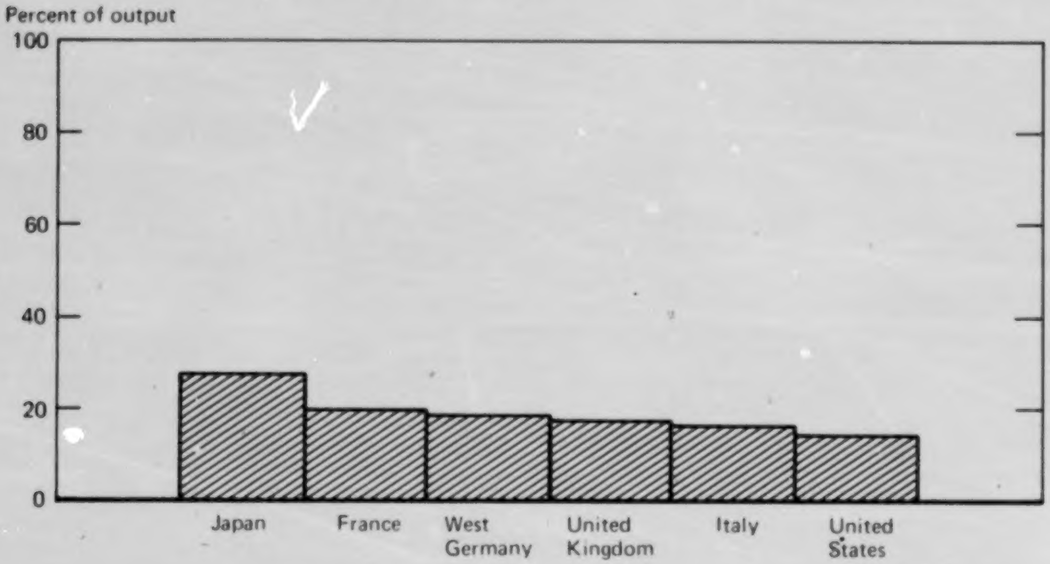
Industrial Relations

A people-oriented management, harmonious personnel relations, and an attitude of teamwork, coordination, and communication provide a favorable climate for industrial peace in Japan. Employer-employee relationships are collaborative; for example, about 6 million workers in Quality Control Circle groups are engaged in a unique voluntary shop-floor program to solve productivity and product-defect problems.

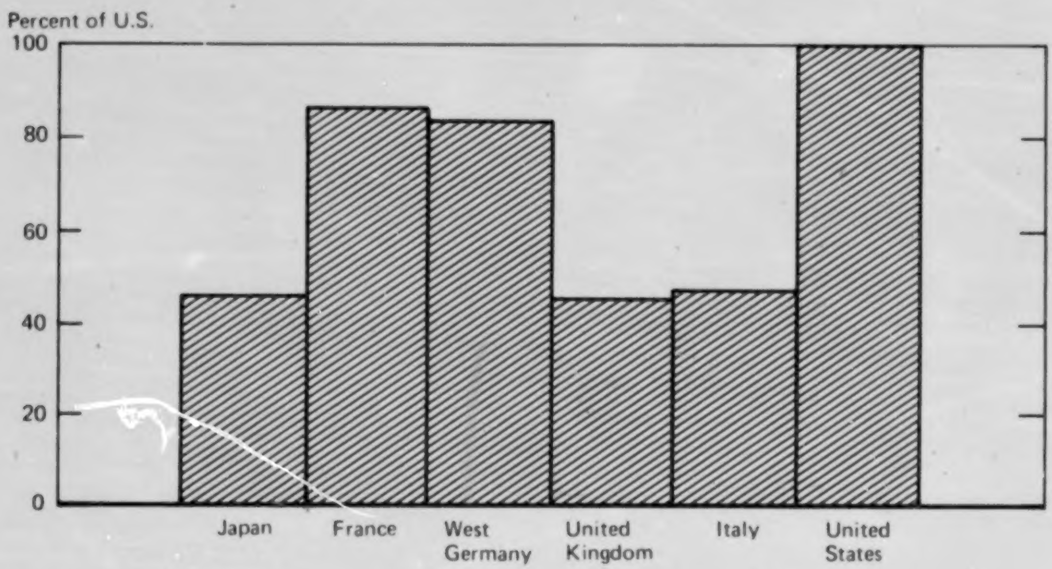
The permanent employment system covers almost a third of the Japanese labor force. Because these employees have lifetime jobs, their employment continues even though their jobs may be eliminated through technological changes; as a result, they tend to be reassigned and may receive extensive on-the-job training and retraining.

The recession of 1974-75 reportedly has weakened, but not eliminated, the Japanese lifetime security system and the bonds of mutual interest between employer and employee. Some firms went into

Chart 6
Fixed Nonresidential Capital Investment as Percent of Output, Average 1970-76



Capital Stock Per Worker Employed in Nonresidential Business, as Percent of U.S., 1971



Source: Capital investment as percent of output, U.S. Department of Labor, Bureau of Labor Statistics; capital stock per worker employed, E.F. Denison, *The Contribution of Capital to Postwar Growth of Industrial Countries*, Brookings Institution, 1977 bankruptcy, and unemployment rose to 2 percent in 1975. Trade-offs between job security and wage increases may become more extensive, but experts believe the permanent employment system will probably survive.

Productivity Improvement

Under these favorable economic and institutional conditions, Japan's productivity has advanced at a rapid rate since World War II, and the gap between United States' and Japanese productivity levels is closing. In 1977, output per employee in Japan stood at about 62 percent of the U.S. productivity level, compared with 25 percent in 1960.

IMPROVING THE NATION'S PRODUCTIVITY

IN NOVEMBER 1975, CONGRESS PASSED the National Productivity and Quality of Working Life Act to make the country aware of the benefits of productivity growth and to encourage initiatives that will result in better productivity performance. The law set forth, as national policy, the need for joint deliberation and action by leaders of business, labor, government, and the public, and it required the National Center for Productivity and Quality of Working Life to seek the commitment and contribution of each group.

People generally agree that productivity growth is important, but their suggestions for achieving progress differ. Engineers are likely to give priority to technological change, businessmen promote capital formation and deregulation, labor favors enhancing workers' skills and security. In practice, these approaches are highly interdependent; one reinforces another. Introducing a new process, for example, requires innovation, capital investment, and a trained work force. A realistic productivity improvement policy features the interaction of many factors and disciplines and a coherent program that draws on many sources.

The National Center, and other productivity centers around the world, are founded on the premise that a multipartite approach can encompass differing viewpoints and help develop a consensus in support of a broad range of actions that can improve productivity. To explore the major opportunities for improving productivity, the Center has convened panels of experts from business, labor, consumer groups, the universities, and governments; it has conducted and commissioned studies to supplement existing information; it has held conferences and workshops on various aspects of productivity; and it has sponsored demonstration projects to encourage the adoption of "best" practices in the public and private sectors. The Center's Board of Directors has identified four broad policy areas in which labor, management, and Government could develop and implement programs to improve productivity:

- Accelerating technological change
- Encouraging capital investment
- Developing human potentials
- Improving relationships between business and government

>> ACCELERATING TECHNOLOGICAL CHANGE <<

The Center, with the help of an advisory panel, undertook an extensive review of the technological innovation process. It consulted with managers of large corporations and small technology-intensive companies, as well as with international experts on technological change, researchers, Government officials, and engineering educators. It sponsored a study tour of Japanese plants by a group of industry, labor, and Government representatives, and it has commissioned a series of papers on technological change.

Technology and Productivity Improvement

A large share of productivity improvement is the result of using new production methods, materials, processes, and/or machinery--that is, new technologies. These changes, by affecting the scale of production, product design, or the effectiveness with which operations are carried out, reduce the amount of labor, materials, energy, or capital used to produce a unit of output.

Occasionally--not often--major technical breakthroughs revolutionize productivity levels throughout an industry, or even many industries. The normal course of events, however, is that a series of minor improvements accumulate and spread through an industry to the extent that its productivity shows some overall improvement. It has been estimated that it takes a rough average of 10-15 years for an invention to advance from the drawing board to enough shop floors to improve industry productivity. It will move through several stages along the way:

1. It must be invented, tested, and produced.
2. Potential users must acquire information about it.
3. Users must weigh its economic feasibility and decide to invest in it.
4. It must be put into place, "debugged," and proved to be efficient in actual use.
5. It must be adopted by enough firms to affect an industry's overall productivity.

The recent slowdown in productivity growth suggests that the flow of innovations into application may be taking longer now, but there is no direct evidence of this. It would be useful to learn more about the innovation-application process for various types of new technologies: How long does the whole process take? How long does it take to advance from one stage to the next? At what stage is the United States compared to other countries? Data of this nature are needed to help gauge the pace of technological change, industry by industry.

The Innovation Rate

In recent times, organized research and development (R. & D.) has been the primary source of advances in scientific and technological knowledge. Some economists treat R. & D. expenditures as a form of capital investment in the stock of knowledge, separate from tangible capital or human capital in the form of education. Industrial R. & D. outlays tend to be positively correlated with productivity growth.

The Decline in R. & D. Outlays

During the past decade, R. & D. outlays have not kept up with economic growth. This relative decline could foreshadow a slowdown in the flow of technological change and productivity growth during the next decade. Several indicators are noteworthy:

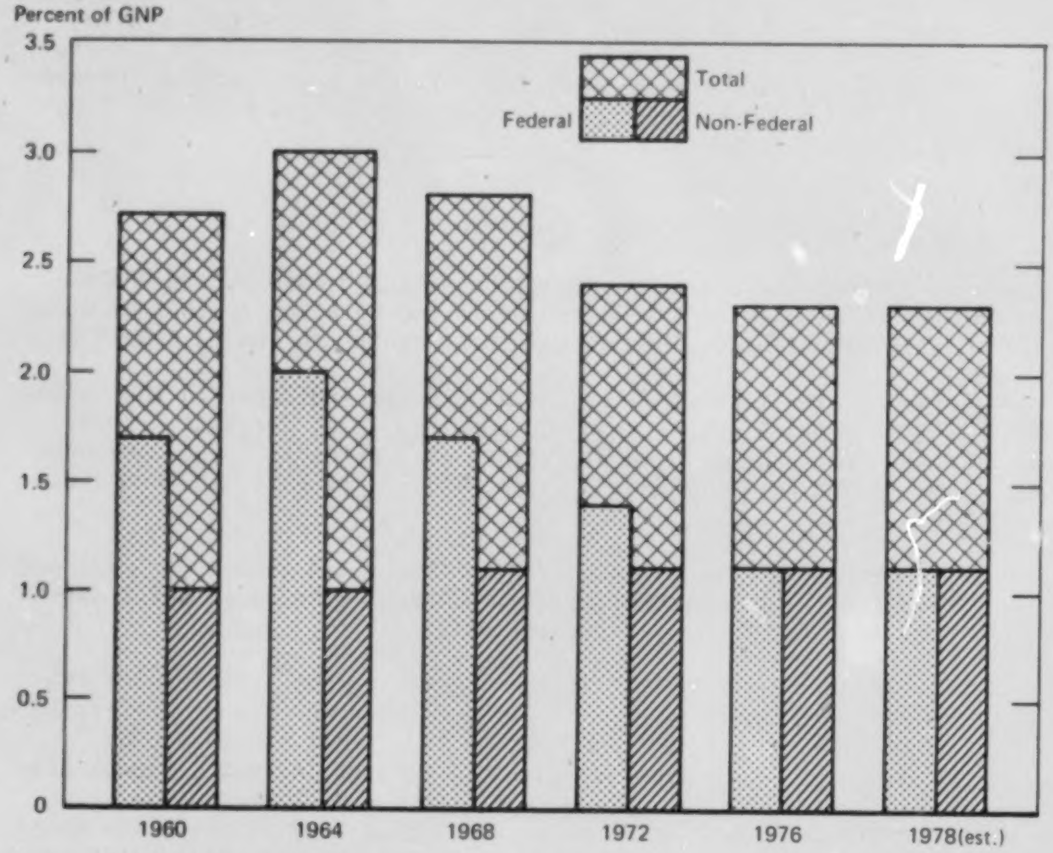
--Total R. & D. spending in 1977, according to National Science Foundation (NSF) estimates, was $40.8 billion, or 2.2 percent of the gross national product. The dollar amount has risen each year, but as Chart 7 shows, since 1964, these dollar amounts have represented increasingly smaller proportions of GNP.

--Between 1961 and 1967, R. & D. expenditures (in constant 1972 dollars) increased at the rate of 6 percent annually. The level in 1977 was about 4 percent below 1968. In the near future (to 1985), the NSF expects R. & D. expenditures to rise only 3 percent a year; the R. & D. share of GNP may decline to 2 percent.

--Private business investment in R. & D. constitutes about 47 percent of all outlays for R. & D. Private R. & D. (in constant dollars) increased at a 2.7 percent annual rate between 1967 and 1974, compared with 6.9 percent between 1957 and 1967.

--The growth of R. & D., measured in person-years of scientists and engineers engaged in R. & D., stopped after reaching a peak of 558,000 in 1968.

Chart 7
National R&D Expenditures as a Percent of GNP by Source, Selected Years, 1960-78



Source: National Science Foundation

Figures on R. & D. activity are subject to two important qualifications. First, they measure input to research, not output, and they do not reflect the creativity or productivity of the scientists and engineers who carry out R. & D. Second, in the field of science and technology, the "quality" or significance of results--whether innovations or discoveries--is fundamental, but not easily measured or compared.

One significant feature of the American R. & D. effort is the new direction it has taken since the mid-1960's, the peak of space and defense research. Now, the pressure to protect the environment and the consumer and rising energy and materials prices motivate much of the R. & D. effort. For example, the automobile industry, as a result of Federal regulations on fuel economy, pollution, and safety, is concentrating research on reducing vehicle weight, designing emission-free auto power plants, and developing new safety devices for passengers.

Another feature of present R. & D. efforts is their short-term outlook. A 1978 report by the American Association for the Advancement of Science finds that industry, faced with inflation and uncertainty, is directing its research dollars toward low-risk, small-scale projects with a quick payoff and toward modest improvements in existing products; there is less interest in major, long-term, innovative developments.

R. & D. Commitments by Other Countries

Comparative data show that since the mid-1960's, the United States' R. & D. effort has been declining relative to that of other industrial nations. This is evidenced by the following comparisons:

--Although the absolute level of R. & D. expenditures in the United States remains higher than the combined total for West Germany, Japan, and France, R. & D. outlays as a percent of GNP have been increasing in the USSR and Japan, while ours have declined since 1964.

--Nondefense R. & D. expenditures in the United States for 1971 are estimated at 1.8 percent of GNP, compared with Japan's 2.1 percent and West Germany's 2.0 percent.

--The proportion of United States' patents granted to foreign inventors has been rising. In 1961, foreign inventors were issued 17 percent of all U.S. patents; by 1975, this percentage had doubled. In some types of patents, foreign inventors predominate.

--Research and development on manufacturing production technologies seem to be lagging in the United States. For example, experts have reported to the Center that the United States trails West Germany in R. & D. in metalworking; the metalworking industries are vital to productivity improvement because they produce the tools and equipment used by other industries. The Japanese government is giving its full support to R. & D. on highly automated, flexible manufacturing systems that are used to produce a wide variety of products at minimum cost.

The effect of the United States' R. & D. lag is aggravated by the transfer of new technology from the United States to other advanced and developing countries. "Turnkey" projects--technology packages which include plant construction, installation of equipment, training of workers, and management and marketing--are said to be competing with U.S. manufacturing plants in an increasing number of industries.

Adding the effect of the United States' deemphasis of R. & D. to the slowdown in capital investment and economic growth, the National Science Board and other authorities conclude that the current environment for innovation seems to be less favorable than in the 1960's and the momentum of technological progress may be slackening.

Obstacles to Technological Change

There is no lack of opportunities for accelerating technological innovation, but there are many, complex factors that make it difficult to use these opportunities to advantage. Simon Ramo, at the Center's 1977 conference on the future of productivity, commented that "the bottleneck is not science and technology per se; it lies instead in the arrangement-making process among government, private enterprise, and science and technology."

Following Ramo's lead, a good place to begin trying to improve the rate of technical change might be with closer cooperation and communication among the different groups in the innovating process. Finding common ground among the scientists, engineers, inventors, manufacturers, distributors, users, government, and others in this complex chain is a challenge; they pursue different and sometimes conflicting goals, and they are motivated by different incentives and rewarded in different ways.

Barriers to Innovation

The pace of innovation is affected by many nontechnical factors--the state of the economy; the profitability of investment; the availability of capital; patent, tax, antitrust, and regulatory policies; product liability laws; the structure of industry; the skills and knowledge of management and the work force; the pressures of organized interest groups; and a host of other factors.

The impact of these factors varies according to the character of the firm. Small, science-based companies need access to venture capital. Large companies are concerned about the antitrust implications of working together on joint ventures. The availability of talented scientists and engineers is particularly critical to technology-intensive companies.

The Center has concentrated on exploring potentials for technological change beyond the R. & D. stage and on identifying opportunities to facilitate the process through synergistic, cooperative efforts among producers of new technologies, potential users, universities, government, and others.

Industry and university experts report a number of managerial barriers to more rapid technological innovation. They include:

- inadequate communication and coordination among the research, design, production, and marketing functions of producers of new technology
- neglect by engineering and management education of the subjects of industrial marketing and human factors
- the tendency in large companies for many decisions on innovative ventures to be made by conservative managers who emphasize short payback periods
- the inability of firms to cooperate on fundamental research projects because of possible antitrust violation
- the difficulty small firms find in raising capital for new products

The lack of close relationships between engineering schools and manufacturing industries also impedes the technological innovation process--a barrier not present in some of the major competitive countries. Although the supply of engineers appears to match the demand, the skills young engineers supply do not always match what is demanded of them. Industrial employers have reported to the Center that recently graduated engineers often lack the practical knowledge needed to achieve technical change and productivity improvement at the factory level. The engineering curriculum also has been criticized for emphasizing prescribed techniques rather than creativity and boldness.

The training of managers generally gives too little attention to the concepts of productivity and new measurement tools for improvement. The Center has collected and disseminated information about comprehensive programs some firms have developed for productivity improvement. These programs include productivity trend assessment, value engineering, productivity audits, group technology, management by objectives, and similar "software." The benefits and problems of these useful, low-cost managerial techniques are not as well known as they should be.

Systems Barriers to Applying New Technologies

Many commercially feasible, productivity-enhancing technologies have not been adopted widely because of obstacles that individual firms are unable to overcome by themselves. The Center identified several innovations in metalworking and food distribution that could increase productivity in these industries if enough firms would use them. Their application has been impeded, however, by institutional and organizational obstacles.

--Metalworking. Numerical control of metalworking machines and flexible manufacturing systems could help raise metalworking productivity. These manufacturing systems permit automation of small-lot production and, hence, more variety in design than mass production allows. Their information requirements are much greater, however, and progress in adopting them has been slower than anticipated.

A report to the Center from the Illinois Technology Research Institute identified three major barriers--aside from general market factors--that have prevented more small firms from adopting numerical control techniques:

- the inability of small manufacturers to test objectively the new techniques on their own products, independently from the vendor
- the difficulty of measuring the indirect benefits of automated equipment, such as the value of flexibility to a small firm
- the fear of too much costly downtime, because complex machinery cannot be repaired quickly

Another Center study reports that the lack of an adequate system for training workers in new maintenance skills is a serious handicap to the adoption of new machines.

The problems that have inhibited the use of more productive methods in metalworking are not technical ones. They are economic, social, and managerial, and most could be resolved by closer cooperation among producers and users of the new equipment, educational institutions, and Government.

--Food Distribution. The Center found that the use of modular shipping containers could reduce food waste, make better use of truck capacity, and facilitate warehousing. Adopting this simple innovation would require that grocery manufacturers, truckers, retailers, and wholesalers agree on standards and costs, and so far such an agreement has not been forthcoming.

Significant productivity increases also might be realized if industrywide agreement could be achieved on standard symbols to identify the contents of shipping containers. Here again, the Center has been trying to obtain a workable consensus among food processors, wholesalers, retailers, container manufacturers, and equipment vendors.

Promoting a Common Approach

Accelerating the introduction of productivity-enhancing technology into an industry requires a broader management perspective than often exists. Although market forces inspire technical change, some industries need a better coordinating mechanism to carry it out. In fragmented industries, no single firm can introduce certain critical operational changes; the cooperation of many others, both within and outside the industry, is needed. In such cases, Government--acting only as the catalytic agent--could help resolve, not only technological problems, but also economic and social issues, which cannot be settled solely through the working of the marketplace.

>> INCREASING THE RATE OF CAPITAL FORMATION <<

Research and development makes innovation possible, but it is capital investment that translates innovation into new practices. Incorporating better methods and more modern technology into the production process is an essential ingredient of productivity improvement. The rate of capital formation is not independent of the economic climate, however, and in periods of prolonged inflation, the rate is disappointingly slow.

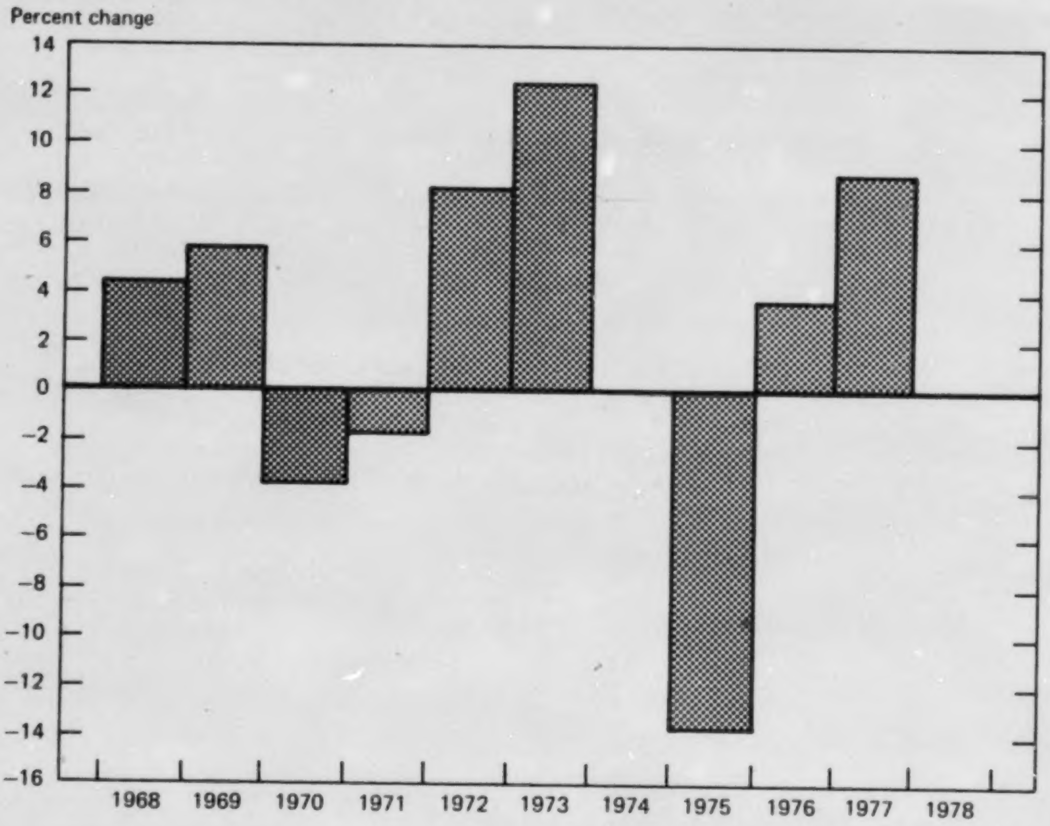
Recent Unfavorable Trends

The Center, in cooperation with a committee of business, labor, and government leaders, reviewed some studies on the outlook for capital formation. Much of this research has emphasized the unfavorable impacts on the volume of saving and investment of such restraints as inflation, business uncertainty, employment instability, and insufficient return on investments. These factors may be largely accountable for a number of discouraging trends:

--The rate of growth of the capital-labor ratio, which is a measure of capital intensity, has slowed significantly. The capital-labor ratio increased at an annual rate of 3.0 percent during the 1947-67 period; during the 1967-73 period, it declined to 2.5 percent a year, and then to 1.3 percent a year during the 1973-77 period. These figures exclude investment to meet environmental standards.

--Real fixed investment in plant and equipment is lagging behind the 10 percent annual rate of increase the Carter Administration estimates is needed to bring the economic recovery along a balanced path to full employment, as well as to meet the capital requirements of the 1980's. Chart 8 shows the wide fluctuations of real fixed investment in the early 1970's. The average increase was less than 3 percent a year; the increase in 1977 was 8.8 percent. Nevertheless, the recovery in investment since 1975 has been weaker than in other postwar cyclical upswings. An important factor in this weakness is the continued low rate of capacity utilization, which discourages new investment.

Chart 8
Gross Private Domestic Fixed Nonresidential Investment, Year-to-Year Percent Change, 1968-77



Source: U.S. Department of Commerce

--The rate of capital investment in the United States in the past 20 years has been lower than in other industrial nations with higher productivity growth rates. This difference reflects, to a great extent, those countries' faster economic growth, lower unemployment, and higher capacity utilization. It is also influenced by tax and other government policies abroad that favor capital investment compared to consumption.

--The composition of capital expenditures has shifted markedly in two respects:

- Larger amounts of the dollars invested are earmarked for meeting environmental and occupational health and safety requirements. Investment in capital equipment for environmental purposes now accounts for about 9 percent of investment outlays in the manufacturing sector. If these mandated capital expenditures are excluded from the data, investment, as a share of value added, has actually declined in the manufacturing sector since 1966.

- The sharp rise in the cost of energy after 1973 also has changed the allocation of capital investment. As the prices of oil, coal, and gas rise more rapidly than other costs, industry is said to be more interested in investments that will reduce energy costs. This is cited as a key factor in weakening the effect capital formation has on labor productivity.

--The profitability of investment has deteriorated. In 1976, after-tax rates of return on capital, reflecting replacement costs, averaged 5.9 percent compared with the average of 8.9 percent during the mid-1960's. In 1977, the rate rose sharply, but it is still low in view of the greater risks and uncertainties of investment today.

--After a period of prosperity in the 1960's, small, technically based enterprises--long a major source of product innovation--face difficulties in raising capital for starting up, as well as for growth. Only 181 new, small-company issues were underwritten between 1973 and 1977, compared to 1,911 between 1968 and 1972. This sharp drop probably reflects the cutback in R. & D. expenditures and the decline in U.S.-held patents, as well as tighter money and higher risk aversion. The financial starvation of small, growing firms is considered an obstacle to the development of new technology.

Capital Investment and Productivity Growth

How much does capital investment contribute to productivity compared to other sources? It has been estimated that about 20 percent of the postwar improvement in productivity derived from the increase in tangible capital (including structures, equipment, and inventories) per labor hour. This is slightly greater than the importance attributed to advances in labor quality (education and training). The effect of capital investment, of course, cannot be disentangled from that of the technology it carries--both are essential to productivity-enhancing technical change.

Many economists believe that a faster rate of economic recovery would stimulate sufficient savings and investment to expand productive capacity and update aging facilities on a larger scale than at present. Others feel that additional incentives will be necessary to encourage productivity-enhancing capital investment, particularly in the capital-intensive energy-producing industries. A mix of monetary and fiscal policies designed to encourage productivity improvement should balance the effects capital investments have on productivity against those of investments in R. & D. and in intangible human capital--education, training, and health of the work force.

>> DEVELOPING HUMAN POTENTIALS <<

Employees, employers, and managers are crucial factors in the way resources are used in production. The contributions of capital and technology to productivity improvement depend on how effectively people apply new methods and machines. The Center has concentrated on three elements of human resource development:

- the role of the worker
- job security
- training and retraining

Enhancing the Role of the Worker

Workers, today, have a greater potential than ever before for making large contributions to productivity. They are considerably better educated and more widely traveled, and television has expanded their range of experience and information. These factors have also raised, and changed the nature of, workers' job expectations. There is a growing belief all over the world that the traditional organization of work, and the workplace itself, is changing to satisfy the physical, economic, social, and psychological needs of the modern work force. And it is only by satisfying these needs that progress can be made in realizing the full potential of modern technology.

Changing Aspirations

The recent emphasis on meeting the expressed and unexpressed desire of workers for a more satisfying and safer work environment is a new episode in the long history of workplace reforms. Over time, the efforts of unions, progressive employers, and social legislators have resulted in better working conditions: child labor and sweatshops are relics of the past, and shorter hours, vacations, safer workplaces, and many other improvements are the rule. Seniority, grievance procedures, and the right to negotiate collectively the rates and rules for work have helped counter the alienation and powerlessness that infect people in a highly organized, technological society. These improvements are only building blocks, however; changing circumstances give rise to new expectations and new interest in alternative ways of working.

The U.S. Department of Labor's Quality of Employment surveys, taken in 1969 and 1972-73, ranked pay and job security high on the list of job expectations. But it also found that workers want many other opportunities--to receive training; to use their talents more fully; to have greater flexibility in work hours, education, leisure, and retirement; to have greater protection against health and safety hazards on the job; and to exercise greater control over the way their work is performed. Only a small minority of those surveyed--not more than 20 percent--expressed dissatisfaction with their jobs. This minority view is noteworthy, however, for it was expressed by young educated workers, whose views may dominate in the future.

Today, both labor and management are searching for new ways to accommodate the aspirations of the work force and, at the same time, meet the needs of economic survival. Group incentive systems, flexible work schedules, autonomous work teams, job redesign, goal setting, and other new techniques are being tried, with varying degrees of success. According to a Work in America Institute study of 103 experiments, the programs showing the most promise for improving both productivity and job satisfaction seem to be comprehensive ones aimed at the social, psychological, physical, and technical aspects of the work environment: performance recognition, skill training, participation in planning the work, safety and health protection, stress reduction, and appropriate equipment.

Labor-Management Cooperation

Employees today have a large stake in the productivity and survival of their firms. A large share of employee compensation is in the form of pensions, health and welfare benefits, and other wage supplements that depend on continuous employment with a particular firm. Improving a firm's competitiveness and the quality of life on the job is in the mutual interest of workers, unions, and industry management.

The Center has attempted to sensitize employers and unions to opportunities for advancing their mutual interests through cooperative arrangements. It has held conferences and workshops at State and local productivity centers and has published and distributed widely case studies and handbooks summarizing experiences with the benefits and problems of labor-management cooperation.

Although the tradition of adversarial relationships between labor and management still characterizes collective bargaining in the United States, the potential for in-plant cooperation is greater than generally realized. A 1974 study for the National Science Foundation found that an overwhelming majority of managers and union officials agreed that "it is possible for the union and management to cooperate on specific programs which will improve productivity." Both groups also endorsed joint efforts to improve the quality of working life.

In-plant Committees. There are more examples of grass roots cooperation between labor and management today than ever before, but the number is still small. The Center has identified more than 215 joint labor-management committees of various types in different industries and localities. Many started as a response to a crisis situation in which mutual survival compelled cooperation and industrial peacemaking. A few are part of ongoing programs designed primarily to improve worklife and work environment, but these programs often have productivity gains as a by-product.

In-plant joint committees, set up through collective bargaining, generally deal with workplace production problems, materials and energy savings, methods improvement, safety and training, and better communication. In those few cases in which mutual trust is high, cooperative efforts may extend to management problems--plant layout, product design, and new products, for example.

The underlying principle of joint consultation is to extend the boundaries of collective bargaining without impairing the bargaining strength of either side. The Center learned that one of the most important benefits of cooperative programs is regular communication between unions and management, apart from contract negotiations and independent of grievance procedures. This can identify sources of stress before they become widespread, and as a result, the collective bargaining process may go more smoothly, and the number and severity of grievances may be reduced.

Several companies and unions in the auto, steel, and food industries presently are experimenting with plantwide union-management committees, and the concept also is being applied in white collar work in government. In 1972, the Center helped start two experimental projects. One, involving the United Mine Workers and the Rushton Coal Mining Company, has resulted in fewer accidents and cost savings; the other, involving the United Auto Workers and Harmon International, deals with quality of worklife experiments.

Area Labor-Management Committees. In some places, labor-management cooperation has been a community effort. Table 5 lists 21 localities where area joint committees have been organized. Some communitywide cooperative activities are integrated with in-plant joint consultative committees. The Jamestown labor-management committee, for example, has four goals--economic development, industrial peace, skill training, and productivity--which are implemented at individual plants, as well as at the community level. Joint efforts are operating in Buffalo, St. Louis, and Muskegon (Michigan), among other communities, and several communities in the Northeast and Midwest are considering adopting the concept.

Table 5

Community-Wide Labor-Management Committees

Date established	Locality	Population served (thousands)
1945	Toledo, Ohio	500
1946	Louisville, Kentucky	750
1958	Jackson County, Michigan	143
1963	South Bend/Mishawaka, Indiana	275
1965	Green Bay, Wisconsin	250
1970	Upper Peninsula, Michigan	322
1970	Fox Cities Area, Wisconsin	200
1972	Jamestown, New York	60
1973	Pittsburgh, Pennsylvania	2,500
1975	Evansville, Indiana	300
1975	Cumberland, Maryland	36
1975	Buffalo, Erie County, New York	1,500
1975	Chautauqua County, New York	4
1975	Mahoning Valley, Ohio	500
1975	Clinton County, Pennsylvania	37
1976	Cheming County, New York	100
1976	Springfield, Ohio	150
1977	Riverside/San Bernadino, California	250
1977	Muskegon, Michigan	157
1977	St. Louis, Missouri	300
1977	North Central Area, Wisconsin	100

Gainsharing Plans. Sharing the benefits of increased productivity in an equitable fashion contributes to a cooperative climate. Profit sharing, stock ownership, group incentive systems, employee ownership, and improshare plans have, in some situations, encouraged productivity improvement. The employee share of productivity gains may be established by collective bargaining, or it might be worked out in joint committees.

Under the Scanlon Plan, employees participate in joint production committees to improve plant operations. Changes in plantwide productivity are measured on a monthly basis, and all employees--maintenance as well as production workers--share the gains according to a predetermined formula. Although only a few hundred plants have adopted Scanlon Plans, several Center studies report favorable outcomes, both in large and small companies.

Outlook for Cooperative Efforts. A climate of trust and acceptance of collective bargaining must exist if labor-management cooperation is to be a successful vehicle for improving productivity and the work environment. At present, few situations in the United States fit this description. Nevertheless, the number of plant and community labor-management cooperative efforts is increasing gradually, particularly in the old, unionized, industrial areas of the Midwest and East, which are facing stiff domestic and foreign competition.

Strengthening Job Security

To a great degree, the prospects that labor and management will cooperate to improve productivity depend on assuring workers that their jobs are secure. Many employees see higher productivity as a job threat, and they are not likely to give their full support to improvement efforts unless they have some confidence that they will still be employed.

The Effect of Expanding Output

Worker displacement is not the inevitable consequence of higher productivity. If output is increased, or if work hours are reduced, employment need not suffer, and it might even expand. Historically, industries in which productivity has risen faster than the national average often are the same industries in which employment has risen by a larger-than-average percentage; conversely, many industries with lagging productivity have had to cut employment.

The record of Japan and many European countries is one of low unemployment and high rates of productivity improvement. This suggests that an expanding economy and a positive labor market policy can provide sufficient jobs for all. Rising national income tends to raise demand for all goods and services. This helps sustain, or even increase, employment in companies or industries with rapidly rising productivity, just as it does throughout the economy.

Adjusting to Technological Change

Even though an industry's total employment level is not adversely affected, technological, market, and other economic changes can bring hardships for particular groups of workers. When major changes are taking place, the personal hardships they cause often can be alleviated by advance planning. If the impact of the change is small enough, normal attrition by retirements, deaths, or voluntary turnover often obviates the need to lay off workers.

The Center has reviewed several instances of technological change in which attrition has minimized layoffs. These companies anticipated the effects of printing automation by including an attrition clause which guarantees that employment, earnings, benefits, and seniority will be maintained. This helps to allay union fears of greater productivity and to eliminate job-manning restrictions.

Private arrangements to ease the problems of adjusting employment include measures to avoid worker displacement, to mitigate financial loss to individual workers, and to assist employees in finding different jobs. Through collective bargaining, some industries have adopted programs that provide advance notice of change, employee reassignment and retraining, seniority in layoffs, protection of pay rates, severance pay, and retirement programs that provide benefits in cases of involuntary early termination. These arrangements are not costless, but their costs can be viewed as part of the costs of the technological change and be paid out of the productivity gains.

According to Center studies, planning ahead for technological change can smooth some of the frictions change involves. Private measures which maximize job security can reduce the burden and stress on individuals and create a climate in which productivity improvement is accepted more readily. In a complex and highly diverse economy, collective bargaining tailors the arrangements to the needs of each firm. It provides the flexibility necessary to devise adjustments suitable to the employees involved, to the local labor market situation, and to the structure and outlook of the firm. Management and unions are best qualified to analyze their own problems and needs and select the most appropriate methods of adjustment.

The Outlook for Job Security Measures

Except for seniority in layoffs, which is a common provision of labor contracts, private measures to assure income and employment are not widely found in American industry. Table 6 shows the prevalence of various types of protective provisions in major collective bargaining agreements. In addition to the provisions shown, most retirement plans provide for early retirement. Only a few companies, most of them expanding, high-technology firms such as IBM and Xerox, anticipate employment impacts and practice employment planning to minimize the displacement that rising productivity carries.

There has been greater interest in job security since 1975, and important expansions of existing programs have been negotiated in the telephone, longshore, steel, aluminum, and printing industries, in which employment has been declining. Unions have shown considerable interest in ways to reduce the number of hours worked annually by providing more vacation, holiday, and leave time. Shorter hours add to leisure time, but their major purpose is to protect and increase jobs.

The prospects for extending job security through collective bargaining and other private methods depend largely on economic circumstances and changes in production planning policies. Few companies treat production labor as an overhead cost, which continues though the direct need for it fluctuates or declines. In an uncertain economy, management generally opposes contractual job security and seeks maximum flexibility. Nevertheless, employers, unions, and government recognize the human cost of unemployment and are seeking ways of stabilizing employment over the cycle.

Private methods of adjusting employment are not intended, nor are they sufficient, to counteract unemployment that results from the secondary or tertiary effects of technological change and productivity growth. Persons displaced because inefficiency or changes in market demand shut down the plants in which they work cannot be helped by in-plant programs. These people can be helped by government measures to stimulate noninflationary economic growth--and with it, employment opportunities--and to provide public training and placement programs, an efficient public employment service, and relocation assistance. These government programs are necessary to insure orderly adjustment to change and to mitigate the human cost of--and resistance to--productivity improvement.

Table 6

Income and Employment Security Provisions
in Major Collective Bargaining Agreements, July 1, 1975

Provision	Agreements		Workers	
	(Number)	(Percent)	(Thousands)	(Percent)
All agreements	1,514	100.0	7,070	100.0
Work sharing				
Division of work	117	7.7	710	10.0
Reduction of hours	307	20.3	2,032	28.7
Regulation of overtime	63	4.2	498	7.0
Job security				
Limitation of overtime	815	53.8	4,819	68.2
Interplant transfer and preferential hiring	457	30.2	3,387	47.9
Relocation allowances	167	11.0	1,910	27.0
Advance notice				
Layoff	643	42.5	3,125	44.2
Plant shutdown or relocation	148	9.8	650	9.2
Technological change	149	9.8	1,192	16.9
Income Maintenance				
Supplemental unemployment benefit plans	235	15.5	1,961	27.7
Severance pay	480	31.7	2,675	37.8
Wage-employment guarantees	185	12.2	1,178	16.7

Source: U.S. Department of Labor, Bureau of Labor Statistics

Encouraging Training, Retraining, and Continuing Education

One of the most important factors underlying productivity growth during the postwar period has been the better educational background of workers. Between 1947 and 1962, the GI Bill was an important vehicle for upgrading the average educational attainment of the labor force. Median years of education for employed workers increased from 10.9 years in 1952, to 12.1 years in 1962, and to 12.6 in 1975.

The amount of schooling people receive does not guarantee its quality or relevance, however. Questions have been raised as to whether American education equips the work force with marketable skills and productive work habits. High unemployment rates among young people reflect, in part, the inadequacy of their preparation.

Programs for career education, vocational training, apprenticeship, and continuing education represent efforts to strengthen the link between school and the workplace. More than 4 million people completed work training programs between 1971 and 1973 (see Table 7), but generally educators are insufficiently aware of the relationship of education to productivity and the quality of working life.

The Center has reviewed several industrial training and retraining programs that prepare workers for technological change. The programs differ widely with the nature of the technological change, the characteristics and needs of the work force, and union and management practices and customs. The Center's case studies confirm the general feasibility and usefulness of various types of retraining as a means of reconciling job security and productivity improvement. This conclusion is supported by the experiences in four different types of industries:

--Printing and Publishing. A wide range of new production techniques in this industry has prompted extensive retraining of middle-aged skilled craftsmen. The adoption of photo-offset, computers, and lithography has made traditional composing room skills obsolete. Labor and management have cooperated to offer workers opportunities for retraining.

- In Chicago, the Graphics Art Institute, a joint employer-union training school, offers formal training in new processes. Journeymen undertake training voluntarily, on their own time. Retraining does not guarantee that mature workers will find jobs, however, and many employers prefer younger journeymen.

Table 7

Estimated Number of Persons Completing Formal Work Training, by Type, Annually

Type of program	Number (thousands)
Secondary:	
Vocational education at the secondary level	1,160
Postsecondary:	
Vocational education at the postsecondary level (public)	420
Adult preparatory vocational education (public)	320
Community colleges and technical institutes	310
Private vocational and trade schools	?
MDTA institutional training	100
Four-year colleges: bachelors and first professional degrees	990
Graduate courses: Masters' degrees	250
Doctors' degrees	35
Military service training	460
Training on the job:	
Apprenticeship	50
MDTA on-the-job training	50
Other formal on-the-job training	?
Total	4,145

Source: W. Wirtz and H. Goldstein, "Measurement and Analysis of Work Training," Monthly Labor Review, September 1975, p. 19.

- At the New York Times, collective bargaining provided the forum for developing a program to retrain composing room and business and editorial employees whose jobs were eliminated by computerization and automation. The agreement allows management freedom to change job content and manning but guarantees lifetime employment and offers retraining to those desiring and needing it. About half of the Times' work force has received a combination of formal and on-the-job training.

--The Processing Industries. Maintenance accounts for a large percentage of worktime in these automated industries, but any single maintenance skill may not be needed full time. To reduce the idle time of single-craft employees, they are learning to be all-around, multicraft mechanics. The potential productivity gains are substantial, but so are the training requirements.

- A union-management training program at Westvaco, a paper manufacturer, provides up to 3 years of on-the-job training and home study courses. Nearly all Westvaco's mechanics have successfully completed the program.
- ALCOA undertook a similar program to try to reduce jurisdictional disputes among crafts and costly downtime. Training is conducted both on and off the job, with classroom training offered on a voluntary basis. Each craftsman learns enough about each skill to handle any task that is not highly specialized.

--High-technology Industries. Constant and rapid technology change in these industries requires that technical and professional employees continuously update their educations.

- IBM offers extensive educational opportunities, in-house and at universities, and steady employment to all its technical employees. It has been found, however, that mature engineers generally do not enroll regularly in courses unless they are assigned to new and challenging tasks; these tasks often are reserved for younger engineers with more recent formal education.
- The Xerox Corporation provides regular training at a central facility for its service technicians and its sales and managerial employees. One of the objectives of the extensive program is to improve productivity. The results are continuously evaluated, and managers are assessed on the basis of how their employees develop.

--Metalworking. One-third of all manufacturing employees work in the metalworking industries, and far-reaching technological change is significantly affecting their jobs. The Center reviewed prospects for worker training and retraining to adapt to such changes as powder metallurgy, numerical control, programmable controllers, and nuclear welding. Retraining employees to operate the new equipment is usually done on the job and at company expense. The cost of downtime on this complex equipment is high, and the lack of skilled repair workers is said to be a significant reason why more firms are not using new technologies. Maintaining the equipment requires specialized training, which is usually provided by the equipment manufacturers. Only a few schools train young people to operate and maintain the new equipment.

The Center's studies, though fragmentary, suggest that complex technological changes require extensive programs to retrain workers at all levels. Cooperative planning for technological changes can minimize the frictions and hasten the productivity improvements these changes offer.

>> IMPROVING BUSINESS AND GOVERNMENT RELATIONS <<

Individual entrepreneurs have played a crucial role in raising productive efficiency to its present high level, but it has not been a wholly private achievement. Economic development and the progress of science and technology depend heavily on the policies and activities of government. Government affects the productivity of the private sector in four important ways:

- It establishes the broad legal, economic, and social framework within which private enterprise operates.
- Its tax and expenditure policies have an impact on technology and growth.
- Its enormous purchasing power affects the kinds of goods and services that are produced.
- Its rules supplement or replace market forces in directing economic activities; this regulatory role has become very important during the past decade.

The Socioeconomic Framework

Private enterprise depends on government to provide the basic foundation upon which social and economic growth is built. Federal, State, and local governments build and maintain roads, schools, bridges, and other essential public infrastructure; they maintain law and order; and they shape incentives, work skills, and attitudes toward profitmaking and competition. The monetary and fiscal policies of the Federal Government affect the level of business activity, the rate and direction of investment, the allocation of resources, and many other economic variables. These policies and services have much to do with the rate of productivity improvement.

Technological Progress

The Federal Government, directly through its expenditures and indirectly through tax and other incentives, has a substantial influence on the levels and priorities of R. & D. and other programs to advance technical changes. According to a Center study, the Government spent $933 million in 1976 for projects that directly affect productivity; about 85 percent of this total went to civilian

R. & D. projects (see Table 8). One of these projects--research in agriculture--has been coupled with an intensive program to disseminate new technologies; this effort has paid off impressively in increased farm productivity.

Table 8

Funds for Federal Activities and Projects to Improve Productivity Growth, by Major Objective, FY 1974-76

(Obligations in millions of dollars)

Major objective	FY 1974	FY 1975	FY 1976
Reported activities and projects, total*	502.5	723.1	933.3
Improve civilian technology	426.9	588.8	786.3
Enhance human resources for productivity growth	39.7	38.9	45.7
Improve management and organization	29.7	88.5	90.0
Measurement and analysis of productivity growth	6.2	6.9	11.3

*Excludes investment tax credits and other forms of tax expenditures to increase capital investment.

Currently, the Federal Government is also supporting research on new mining equipment and methods, automated manufacturing of defense equipment, and advanced maritime technology. Expenditures are increasing for new technology in energy, including research on production efficiency. These large projects by no means exhaust the list of Government projects to advance technology and enhance productivity; they are only a small part of it.

No yardstick exists for measuring the adequacy of Federal support for productivity. Studies suggest that for innovation to affect productivity growth, new technologies must be complemented by capital investment, managerial changes, and worker training. The

Federal Government is devoting more attention to developing the human factors in productivity growth, but it is still a pale effort compared with Federal technology and capital investment programs.

Procurement Policies

As the largest single purchaser of goods and services, the Federal Government theoretically might exert enough "market pull" to inspire the creation and diffusion of new, innovative products and techniques. The Experimental Technology Incentives Program (ETIP) of the National Bureau of Standards is studying the potential of procurement policy for fostering innovation, including the resistance of consumers to Government-generated innovation.

One important way the Government might encourage innovation is by specifying what it wants to buy in terms of what a product or service should do, rather than by how it should be designed. By using these performance standards, the Federal Government has become a national leader in purchasing innovative, energy-conserving consumer appliances--water heaters, kitchen ranges, and air conditioners, among others--and has accelerated the introduction of these goods into consumer markets. Federal procurement policies also have improved the quality of products by figuring a product's price on the basis of its lifetime cost, rather than its initial price.

The Impacts of Regulation

Government regulation has expanded substantially during the past century. The growth of large-scale industry, advancing technology, and changing economic and social standards have brought with them economic and social problems that private efforts cannot solve; only Government is broad enough to seek solutions.

There is little disagreement about most of the goals of Government regulation. Few question the need for controlling monopoly, protecting consumer and worker health and safety, allocating and protecting scarce natural resources, promoting equal employment opportunity, and maintaining trust and confidence in the economic system. There is disagreement, however, about what specifically needs regulating and what form regulations should take.

Not only business, but also consumers, labor, and economists, have criticized the regulatory process. It has been called cumbersome, ineffective, costly, and counterproductive. The Executive agencies, Congress, and the regulatory agencies have conducted extensive studies on opportunities for reforming the regulatory system and reducing negative impacts on the economy. The Center has sponsored conferences and studies on the implications of the regulatory process for productivity.

In certain cases, it appears that reducing or eliminating economic regulation could create opportunities for greater productivity. The original premise for regulation of the transportation industries, for example, has been eroded by technological and economic changes. Now, competitive market forces might be more effective than Government in protecting the consumer and in providing incentives to improve productivity.

Changes in the Complexion of Regulation

There is a long history of economic regulatory programs governing entry, service, and pricing in individual industries in which the market outcome is considered unfair. Industries most affected are railroads, airlines, trucking, communications, banking, and energy. As experience with these regulations has accumulated, industries have adapted to them.

In the past decade, there has been a surge of new Government regulations that affect the performance of business. Virtually all businesses are affected by the new programs, which deal with social conditions. The programs are directed at health, safety, and workplace practices and may alter production processes, product design, and transportation patterns. During their short existence, social regulations have improved the environment and the health and safety of Americans. Their costs have been substantial, however--much larger than originally estimated.

Measuring the Impacts of Regulation

According to a study for the Commerce Department, between 1969 and 1975, the direct costs of complying with air and water pollution and occupational safety regulations, and the costs of crime, appear to have reduced by nearly 20 percent the average growth rate of measured productivity. These estimates of capital costs do not reflect Government interference with day-to-day operations or the results of confusing and conflicting administration of regulations. There is also no assessment of the extent to which regulation delays or deters capital investment for the purpose of modernization.

There is no way to balance the negative and positive impacts of regulation. Although some of the direct costs are measurable, there is no way of measuring the value of changes in the quality of air and water, personal injuries prevented, or other benefits.

Most social benefits are impersonal and indirect. Better health probably improves the productive capacity of the work force, and cleaner air and water probably improve productivity in agriculture, but quantifying these beliefs is something else. The Center found that few companies keep adequate records by which either the cost or the benefits of regulation could be estimated.

The Center has conducted some studies dealing with the impact of regulation on productivity:

--One study attempted to measure the resources wasted in efforts to regulate a problem--tire-quality grading--that turned out to be an inappropriate subject for regulation because of the critical difficulty of defining tire quality in a useful way. The agency involved continued for 12 years to attempt, without success, to establish standards for tire quality; in the process, it consumed millions of dollars of the resources of Government and industry. The regulatory process has worked effectively and quickly, however, in the case of setting tire safety standards.

--Measuring the direct and indirect impact of even a single regulation is exceedingly complex; measuring the impact of regulations on a single industry is even more so. The Center explored the methodological issues raised by attempting to measure the impact of the regulatory process. The study used as an example the steel industry and all the safety, trade, environmental, and employment regulations that apply to it.

The study cast doubt on the relevance of abstract models which reduce the complexities of regulatory costs to a single "impact" estimate. A realistic impact study must take into consideration the adjustments managers make to accommodate regulatory costs to particular economic and trade conditions. Assessing the impact of regulation on even a single industry is probably impractical. More useful would be to stimulate, at the point of enforcement, creative problemsolving on the tradeoffs the regulatory system makes necessary.

One of the lessons of the Center's studies of regulatory impact is that we need to consider more fully alternative ways to achieve social goals. It is important to sort out the cases in which Government intervention is appropriate and useful, those in which private initiatives can handle the problem, and those which call for joint actions. There is an increasing need for acting jointly on complex issues and for encouraging a problem-solving attitude toward them. Regulations impose "command and control" uniformity, but this is not always the most effective or innovative way to solve individual problems.

IMPROVING PRODUCTIVITY IN MAJOR SECTORS

FEDERAL ECONOMIC POLICIES provide the context in which productive activities are carried out and influence whether they will be carried out with greater or lesser efficiency. It is on the "shop floor," however, that productivity improvement actually takes place, and it takes place differently in each productive unit of each sector.

Because specific problems differ among sectors, the Center has conducted or supported studies in terms of problems and solutions in individual sectors. In many cases, the Center has tried to help business and labor find and implement solutions. The Center has focused its attention on sectors in which better productivity could significantly benefit the economy, on sectors in which there exists a basis for labor-management cooperation, or on sectors in which other, complementary Federal programs are active.

This sector-by-sector approach is slow and painstaking, but necessary. There is no cure-all which can be applied across the board to cause national productivity to leap forward. Instead, it is necessary to pinpoint opportunities in each sector and follow them through as a complement to broader initiatives.

>> THE PUBLIC SECTOR <<

Public service is a highly important "industry" in our economy. The 12.5 million State and local government employees account for 15.2 percent of all nonfarm employment; the Federal sector employs another 2.7 million, or about 3.3 percent. Federal, State, and local expenditures account for nearly a third of GNP. As our population has grown, as government has taken on new responsibilities in such areas as mass transportation, special education, and pollution control, and as public and private activities have become more interdependent, people have come to expect more from their governments.

For several reasons, these expectations are sometimes disappointed. Skyrocketing fuel costs, inflation, and rising unemployment have eroded the capability of governments to satisfy public demands. Recessions have compounded these difficulties; they tend to increase demands for public services and reduce the tax revenues with which to pay for them. The "taxpayer revolts" are a symptom of disappointed expectations, but if they spread, they could further reduce the quantity and quality of local public services.

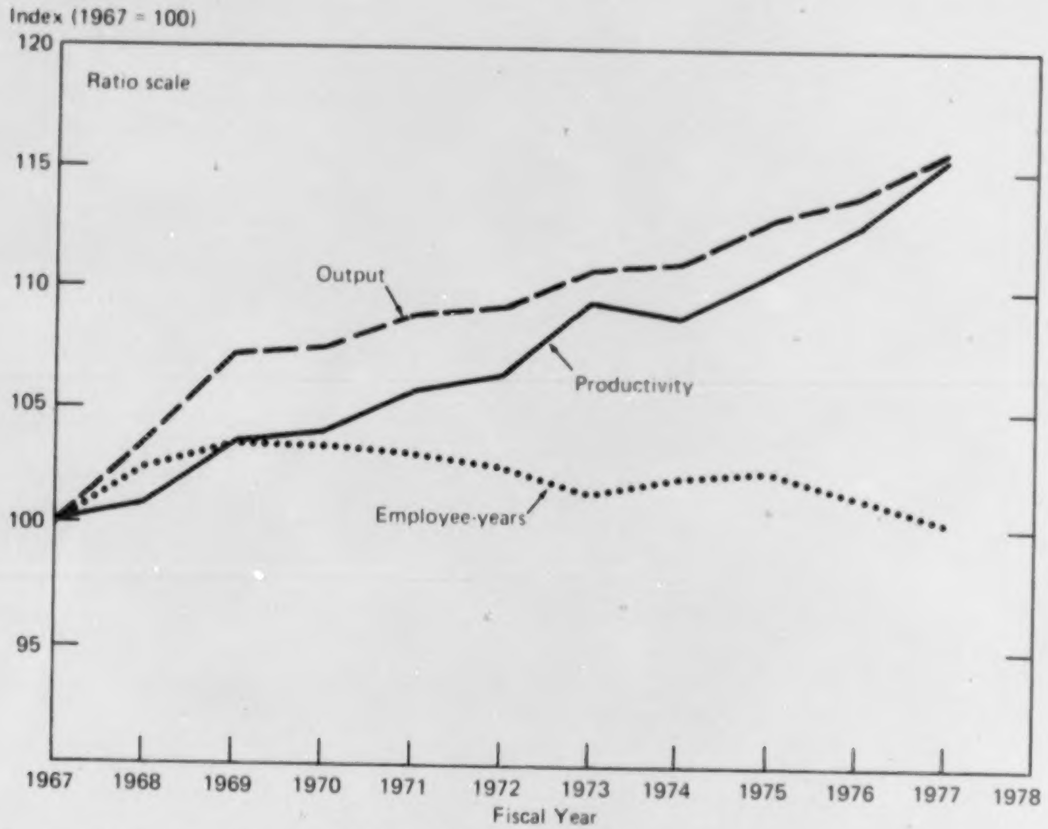
It is is understandable that the public feels that the quality of government services has not improved commensurately with its taxes. According to a report by the Committee for Economic Development, the unit costs of goods and services--materials, fuel, land, equipment, and labor--that local governments purchase have risen 152 percent during the past 20 years; consumer prices have risen only 83 percent during this time. Among other issues, the fiscal crisis that threatens big-city governments has served to call attention to a longstanding need for improving productivity in the public sector. It is the only solution to serving rising demands for public services without raising taxes.

The productivity record of the Federal Government is shown in Chart 9. The Center, through the BLS, collects productivity data for 64 percent of the Federal civilian work force. Data for fiscal year 1977 indicate that Federal productivity grew at an average annual rate of 2.9 percent, considerably above the FY 1967-77 rate of 1.3 percent a year. There are few data for State and local governments, and none that are collected nationally.

The public sector needs special encouragement to improve productivity. Without a clear-cut indicator of accomplishment, such as profits, the incentives to improve productivity are not as strong as in the private sector; indeed, there are strong incentives to maintain the status quo. Professional pride has motivated many public managers to try to improve government productivity, but--especially at the local level--improvement requires the support and leadership of elected officials. There are few political incentives to improve productivity, however. The incentives are to use available public funds to satisfy immediate public demands, by which voters judge the performance of elected officials.

Center-supported studies have indicated that local jurisdictions of the same size are quite disparate in the level, quality, and cost of many of the public services they provide. One study,

Chart 9
Output Per Employee-Year for the Total Measured Sample of Federal Agencies, FY 1967-77

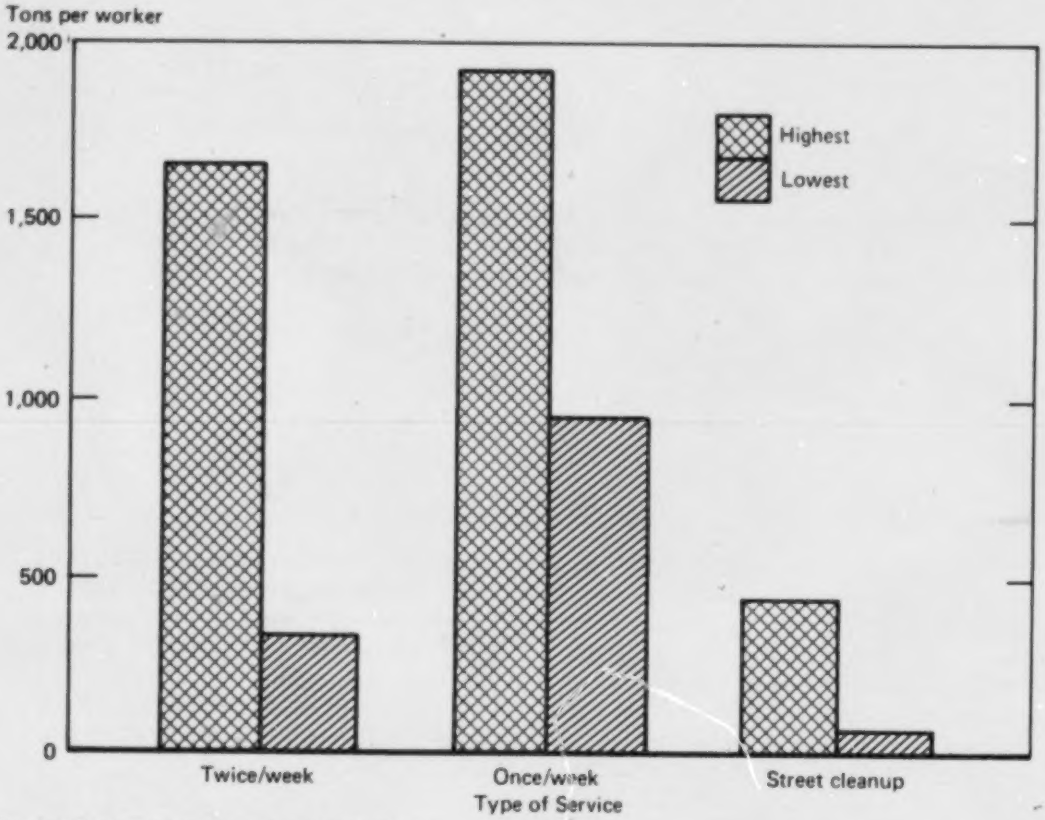


Source: U.S. Department of Labor, Bureau of Labor Statistics

for example, revealed that some cities collect nearly 3 times as many tons of solid wastes per worker as other cities of comparable size and similar characteristics; the range of performance differences is shown in Chart 10.

Data for the Federal Government reveal wide variations in annual productivity growth for similar functions performed by different agencies. For example, during the past 5 years, in the printing function, rates varied from an annual increase of 15.7 percent to a decline of 11.2 percent. These studies suggest that if the performance of all public services could be brought to the level of the top

Chart 10
Range in Productivity Levels, by Type of Garbage Collection Service, Selected Cities, 1973



Source: National Commission on Productivity

performers, it would substantially improve government productivity, nationwide.

The Center, guided by a committee of elected officials, administrators, and union leaders, has tried to develop labor and management support for efforts to identify obstacles to, and opportunities for, improving efficiency in the public sector. The Center also has cooperated with Federal agencies, governmental units, public interest groups, professional organizations, and citizens' associations in joint efforts to create programs to improve public service productivity. By publishing and distributing case studies, self-assessment guides, and other technical materials, the Center has attempted to (1) develop and reinforce positive incentives for government managers to undertake and sustain productivity improvement efforts, and (2) direct research resources into areas of critical need.

There is general agreement that the key to productivity improvement in the public sector is much the same as that in the private sector--better management. Good management in the public sector has several requirements:

- exercising concern for the personal and organizational well-being of employees
- providing incentives for improving productivity, and controlling work performance
- incorporating new techniques and technologies into current practice
- organizing resources to accomplish goals, and reassessing goals when needs change

Personnel Management

The public sector falls significantly short of private industry in its management of employees. A comparative study was made for the Center of the attitudes of public and private sector managers and employees toward their jobs. Public employees and managers were found to have lower opinions of the quality and quantity of the output of their organizations than did their private sector counterparts. The study provides some insights into the attitudes of public and private employees about their work:

--Public employees' opinions about the challenge and satisfaction of their jobs are not different from those of private sector employees.

--Compared to their private sector counterparts, public sector employees have a more negative view of the competence of their supervisors and of upper-level management.

--In terms of equitable treatment in such areas as pay, job security, benefits, and working conditions, public sector employees generally regard their employment situation as favorably as do private sector employees, but public employees feel that an improvement in performance is not necessarily rewarded by promotion or recognition.

--Government employees know what is expected of them in their work, but they feel that they get too little feedback on how well they do it.

These findings are significant because there is a strong, demonstrated correlation between employees' perceptions of the effectiveness of their organizations and actual organization performance. Clearly, better management of human resources, including better communication between management and employees, more management and employee training, and better means of sharing productivity gains, could go far to improve government productivity.

There are several examples at the Federal, State, and local levels of government of cooperative labor-management programs to improve productivity and quality of working life:

--The Center has helped unions and managers at five Department of Defense installations establish joint labor-management productivity or work improvement councils.

--Various quality of worklife programs are being tested in the U.S. Postal Service, the Commerce Department, the Federal Aviation Agency, the Labor Department, and the Tennessee Valley Authority.

--At the Center's suggestion, eight labor-management committees in State and local governments are developing productivity and quality of working life programs based on recommendations of the Center's Public Sector Committee. Experiences with these programs are being exchanged and compared, and an evaluation of the cooperative approach is being prepared.

Better Control and Incentives

A second area of opportunity lies in developing better management control and stronger incentives for productivity improvement. The Center's Public Sector Committee recommended that managers be provided with information on (1) the unit cost and effectiveness of the services they manage, in a form that can be tracked over time and compared with others; (2) the extent to which present government programs meet true citizen needs and are deemed satisfactory by citizen consumers; and (3) the extent to which employees' personal and organizational needs are met.

The availability of time series and comparative data encourages public officials to review their operations to identify areas in which productivity could be improved. It also provides them with examples of improvement ideas that have been used successfully elsewhere.

Each Federal agency head with activities covered by the BLS Federal productivity measures receives data on overall agency productivity performance, comparative data for individual units within the agency, and data for similar units in other agencies. There are no national aggregate data on State and local productivity, but a system for collecting such data could be developed. Center-sponsored demonstrations in New York, Colorado, and North Carolina tested the feasibility and value of collecting and disseminating cross-jurisdictional comparative performance data for seven municipal functions. This experiment was supported by labor and management, both of whom had previously been unwilling to reveal performance data. The tests demonstrated clearly that comparative measurement is feasible.

A Center-sponsored survey among former and present Federal Government administrators found strong support for the idea that stronger managerial accountability would increase public service productivity. The study recommended that:

- agency managers be held accountable for their agencies' levels of performance and rewarded for productivity improvements
- responsibility for productivity improvement be decentralized so that it rests with managers at every level and locality, rather than solely with the central offices of the agency
- agencies with similar functions share successful experiences in improving productivity

Total performance management (TPM) is an experimental method for identifying productivity problems in government and finding solutions for them. The method has been tested by the Center and other agencies in five Federal, State, and local jurisdictions around the country. The system combines performance data (output per employee hour) with survey data on consumer attitudes toward public services and employee attitudes about their work. TPM can be used to motivate managers to take corrective actions and to provide a factual basis for community consensus for productivity improvement.

Technology, Capital, and Operations

Government, like industry, can improve productivity by adopting new technologies--for example, by adopting more sophisticated police communications systems, installing better refuse collection equipment, or using "rapid" water and remote controlled nozzles to improve fire fighting productivity. However, public officials who decide on new technologies and equipment and on improved programs often have little interest in benefits that will be realized after their terms of office have expired. As a result, they opt for using the resources available to them for expanding services and employment opportunities rather than investing in capital improvements, which would bring long-run productivity gains.

Even if officials were so inclined, however, technological improvements require investment capital. A report by the Government Services Administration in 1975 indicated that several hundred million dollars in potential net savings had been lost by the Federal Government for lack of capital commitments. A recommendation of that report was to establish a revolving fund of $1-10 million for capital investments that would expedite technological changes.

The magnitude of the problem at the State and local level is unknown, but it is clear that difficulty in obtaining capital helps divert funds away from productivity-enhancing investments. The need to purchase major equipment out of operating budgets (which in many places by law must be balanced every year), requirements for bond referendums, the absence of depreciation allowances in budgeting, and matching requirements for Federal capital assistance all discourage managers--who are not rewarded for productivity improvements anyway--from applying new technologies.

Substantial productivity gains also could be realized by systematically analyzing operations to see if new methods might be more efficient. Center studies show that in many cases, simple changes--such as combining building inspectors' duties, establishing appointment procedures and single-line queues in food stamp processing, or spacing out motor vehicle licensing over the full year--can bring substantial efficiency gains. An increasing number of jurisdictions are looking for ways to improve the efficiency and effectiveness of public service delivery, but without performance indicators and accountability systems, only a small fraction of the opportunities for productivity improvement are being exploited.

Organizational Changes

As demands exceed the growth of available resources, resource allocation becomes very important. Governments are always in mutation; the population mix, its geographical concentration, and its social expectations change continuously. To be effective, governments must constantly reassess the allocation of their services in the context of these changes. They should determine, for example, if fire stations are located efficiently with respect to where people live, if enough services are being provided to the increasing number of older people, or if recreational activities have been expanded in response to the leisure time people have gained.

Center studies suggest that, in some cases, governments can benefit their constituents more and conserve public resources by providing incentives to solve local concerns privately than by furnishing direct public assistance. For example, governments could help city dwellers improve the physical appearance of their properties by providing do-it-yourself equipment, rather than by providing public maintenance services. Governments could more fully utilize their investments in transit, recreation programs, and the like by advertising the availability of these services. Instead of stepping in to fill a void, government could creatively encourage the private sector to fill the void wherever possible.

The intergovernmental grant system often distorts the way resources are organized to meet goals, because it gives low priority to productivity performance. Research in New York State is beginning to identify methods for incorporating into grant programs positive incentives to improve efficiency and effectiveness. The real benefits of the Federal grant system can be increased by improving the administration of these grants at all levels--not just at the Federal level. The effective impact of grant-supported programs could be expanded without increasing the size of the grants, if the programs were administered more efficiently.

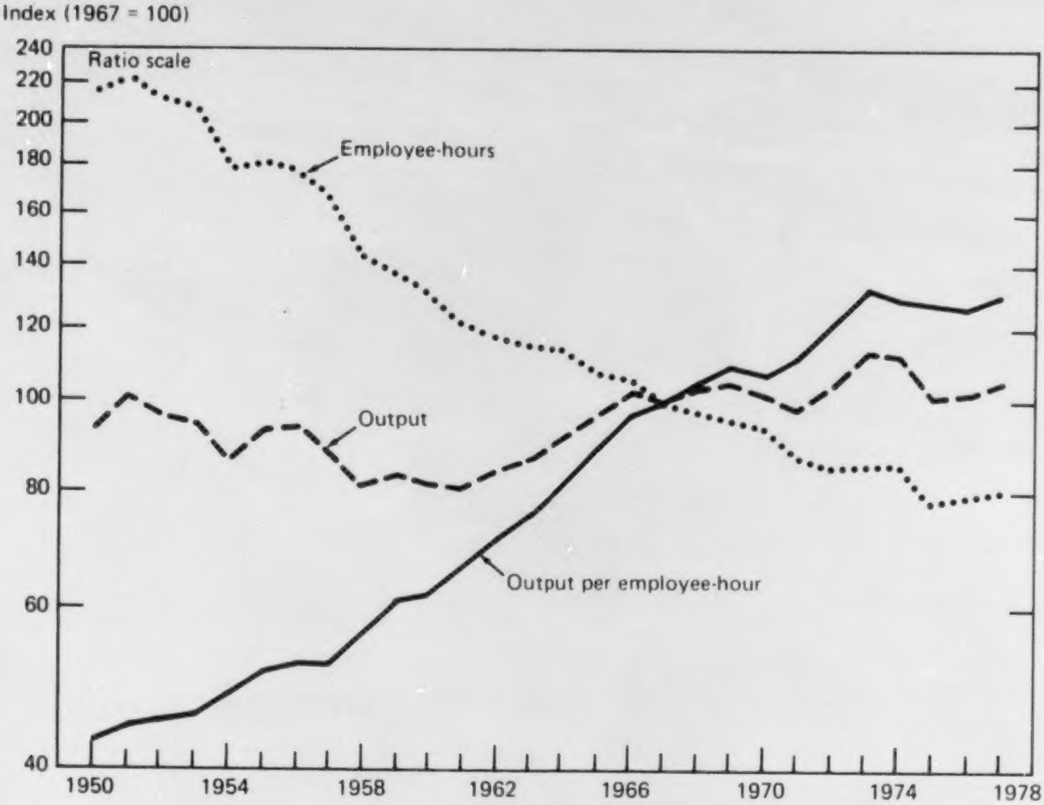
>> RAILROADS <<

The railroad industry has long been experiencing financial difficulties, loss of traffic to other modes, and cutbacks in employment. Despite this decline, railroads still carry 40 percent of all intercity freight, and the industry has an enormous effect on other industries. Especially important today is the inherent advantage rail shipping has in energy use per ton-rate of freight relative to other transportation modes in long-haul movements.

Railroad Productivity

The National Commission on Productivity, the Center's predecessor agency, undertook an intensive analysis of productivity in American railroads. Its rail productivity task force, which included leading government, academic, and industry experts, reported in 1973 on some of the sources of the industry's problems: low capital stock productivity, low return on investment, unreliable service to shippers, obsolete work rules, excessive government regulation, and overcapacity.

Chart 11
Railroads, Revenue Traffic: Output Per Employee-Hour and Related Data, 1950-77



Source: U.S. Department of Labor, Bureau of Labor Statistics

Chart 11 shows that railroad productivity--measured in revenue traffic per employee-hour--has increased at an annual rate of about 5 percent during the postwar period. But the report found that this measure, by itself, tends to give an overly optimistic impression. It does not reflect deterioration in the quality of service: cutbacks in passenger service, frequent breakdowns, and low on-time performance. The measure does indirectly reflect the decline of low-productivity, short-haul traffic; moreover, it reflects the large amounts of revenue traffic gained by refusing to handle less than carload lots, even though shippers suffer a loss in service.

The study found that the industry's problems are better understood in terms of the low productivity of its capital investments, to which the industry's unfavorable financial picture testifies.

The major recommendations of the Task Force were:

- to expand use of containerization in order to increase intermodal shipping and reduce handling
- to abandon and rationalize light-density lines in order to reduce excess capacity
- to modernize regulations in order to increase experimentation and innovation
- to improve labor-management relations and revise work rules in order to permit shorter, more frequent trains
- to encourage end-to-end railroad mergers in order to stimulate competition among continental systems

Freight Car Utilization

The Productivity Commission, with the cooperation of railroads, labor unions, shippers, and receivers, and government agencies, devised projects for improving the utilization of railroad capital equipment, especially of the 1.7 million rail freight cars. At the crux of the problem were excessive movement of empty freight cars, with associated fuel wastage; freight car congestion on lines and in yards; and excessive switching costs. Some symptoms of these problems are:

- The average freight car carries 16 loads a year or 1 load every 3 weeks.
- The average freight car is empty for 42 of every 100 miles that it actually moves.
- Whether loaded or empty, a car is in motion for an average of just 3 hours a day and travels only 58 miles.
- The average freight car delivers a shipment at an overall average speed of 3.1 miles an hour.

A Commission study of the excessive movement of empty freight cars found that some of the underlying factors were the imbalance among freight movements in the Nation and the concern of individual railroads to have their own cars returned. The problem was aggravated by Interstate Commerce Commission enforcement of restrictive industry rules on the return of cars.

The Center's Task Force on Rail Car Utilization designed, on an experimental basis, a rail car clearinghouse which maintains the availability of cars to owners, but significantly reduces empty car mileage. Railroads are free to use each other's cars as if they were their own; that is, they are freed from restrictive rules on loading and return of "foreign" cars. A system of debits and credits is maintained for each railroad and "cleared" with the other participants on a weekly basis. Only the cars for which there is no freight are returned empty, instead of the gross number of cars as continues to be the operating procedure outside the experiment.

The ICC granted exemptions from restrictions, and the experiment was begun in September 1974. Three railroads and the American Association of Railroads performed the clearinghouse function. The initial experiment was evaluated and expanded, with improvements, to 10 railroads during 1976. The program is now under the guidance of a steering committee representing Government, industry, shippers, and the railroad brotherhoods.

An evaluation was made in 1978 of the 10-railroad clearinghouse. Freight car movement during a 3-month period in 1976, before the expansion, were compared with freight car movements 1 year later, after the expansion. The study showed substantial reduction in the movement of empty cars from line to line. The estimated savings that can be attributed to the clearinghouse amounted to $31 million on an annual basis. Now that the economic value of the clearinghouse has been established, the evaluation study recommends expanding this system to other carriers, developing incentive systems to encourage use of cars of other lines, and extending the system to other car types.

Labor-Management Cooperation

There is general agreement that significant opportunities for improving railroad productivity lie in modifying barriers which over time have become institutionalized in collective bargaining agreements and management practices.

Recognizing their mutual interest in the health of the industry, the presidents of the major railroads and rail unions formed a joint labor-management committee in 1967 to deal with common problems such as rail safety, efficiency of terminal operations, and Government regulations.

A task force was organized in 1972 to undertake joint improvement projects in terminal operations. The first project, in St. Louis, was financially supported by the Federal Railroad Administration. The St. Louis Terminal project involved experimental changes in collective bargaining and management practices to improve terminal operations. Major achievements include a one-third reduction in the average time cars are in terminals and fewer accidents. The success of the St. Louis project led, in 1976, to starting similar cooperative projects in Chicago and Houston.

The railroad industry has a long history of regulation by the Interstate Commerce Commission. The industry and the conditions that affect it have changed since most of these regulations were put into effect, and many of the present regulations are obsolete and act to inhibit productivity improvements. Ways to update the set of regulations that govern the railroad industry are currently under investigation, and reform is to be expected in the near future.

>> APPAREL <<

The apparel industry in the United States employs 1.3 million workers throughout the Nation. It traditionally has been a major employer in the urban centers of the country, particularly in the East, and the primary vehicle for the entry of minorities and women into the labor force.

During the past 15 years, the clothing industry has been hit hard by a surge of imports, as low-wage countries have rushed into this labor-intensive industry. Imports were less than 5 percent of apparel sales in the United States in 1965, but they currently exceed 25 percent and are projected to reach 50 percent by 1985 if current trends continue. As the import pressure has mounted, the industry naturally has sought to stem the flow through trade protection.

Productivity in Apparel

Productivity improvement in U.S. apparel manufacturing has not been adequate to maintain its traditional share of the U.S. market for clothing. Although much of the problem is related to extremely low labor costs in developing nations, there are many other factors that contribute to the condition of the industry today. Many of those factors result from poor relationships between labor, management, and Government.

The apparel industry is extremely fragmented and competitive. There are more than 23,000 plants scattered throughout the country. Average employment is only 62, and profits are low. Consequently, there has not been a history of rational, enthusiastic, and sustained innovation. Individual firms have not had enough resources to engage in much R. & D., and their purchasing power for new equipment has not been sufficient to entice others into R. & D. in apparel manufacturing. Innovations have been left to a few equipment manufacturers, and the general rate of change has been slow.

The production system, therefore, remains geared to its low-skill, low-technology past. Newer pieces of equipment are expensive, and they involve new methods which require costly changes in individual firms' entire production systems. Today, such changes can only be made by the largest firms, leaving the bulk of the industry behind.

To become competitive in the future, this industry needs its "share" of U.S. technological know-how and expertise. Bringing about this change requires joint efforts by labor, management, and Government. Through a process of evolution and gradual change, the the various factors that productivity improvement entails could be integrated into a complementary package geared toward a stronger industry.

A Cooperative Productivity Effort

Beginning in July 1977, men's tailored clothing, a major branch of apparel manufacturing, initiated an effort to improve its productivity. Under the joint leadership of the Amalgamated Clothing and Textile Workers Union and the Clothing Manufacturers Association, an effort was undertaken to identify the most critical barriers to the industry's productivity growth. Working together, labor and management representatives agreed on a comprehensive set of objectives to revitalize their industry. In addition to the industry's own resources, the Department of Labor and the Department of Commerce provided nearly $5.5 million for parts of the effort.

The areas identified as needing attention include:

--Recruitment, Training, and Retention. The apparel industry experiences an inordinately high labor turnover rate (twice the average for all manufacturing), and the whole recruitment and training effort is time consuming and costly. Accordingly, one priority is to improve these operations and to analyze the results for both Government and industry use.

--Forecasting. The set of decisions required to produce one season's line of clothes from styling to materials commitments extends over 18 months. It is highly dependent upon forecasts of the nature of future markets. Present forecasting techniques in this industry are unsophisticated and need upgrading to the level applied by other industries.

--Production Control. Producing tailored clothing requires a complex set of incremental steps: patternmaking, to cutting, to sewing, to the finished good. Goods in process represent a major investment, and more rapid throughput would be a valuable asset.

The micro-processors that some other industries use could be applied to apparel manufacture to enhance productivity. Demonstrations and analysis of this equipment are planned.

--Innovation Experience. A few major innovations are available to the industry, but firms lack experience with introducing change into their processes. This inhibits them from making major investments. Experience with innovation needs to be gained gradually --at lower levels of investment and change. Accordingly, the industry will seek from its member firms "mini-innovations"--low-cost innovations at the plant level. Government will fund 75 percent of the implementation cost, and this should overcome the barrier of inadequate funds from plant-level "experimentation."

--Research and Development. As the industry seeks higher productivity, it will find that the techniques and equipment now in use are inadequate. The research community has paid little attention to apparel production, and it is not known to what extent existing technology could be applied in this industry to improve productivity. It is hoped that by establishing a cooperative research arrangement, members of the research community will investigate the applicability of technologies of other industries and develop new ones for the apparel industry.

Recognizing the need to maintain a coordinated approach to this wide range of projects, the industry formed a nonprofit corporation under joint labor-management direction to provide management and control to the whole effort. The corporation will integrate results from both Government-supported and industry initiatives into a sustained, coherent program.

The Government's Role

The identified tasks of the tailored clothing industry's proposal would draw upon existing Government resources; new programs would not be needed. The operational tasks the industry requires fall within the responsibilities of these Government agencies:

Department of Labor

Training
Apprenticeship programs
Retaining and mobility
Employment and productivity data

Department of Commerce

Forecasting
Management development
Market and equipment information
Export development
Loans and loan guarantees

Department of Housing and Urban Development

Facilities improvement
Economic planning and development
Business/government cooperation

National Science Foundation

Diffusion of technology
Research and development

It is evident that if the industry's needs can be identified specifically, Government could supply research, training, information, technical assistance, communication, and financial services. With Government, labor, and management cooperation, these resources could be tapped to improve productivity in the apparel industry.

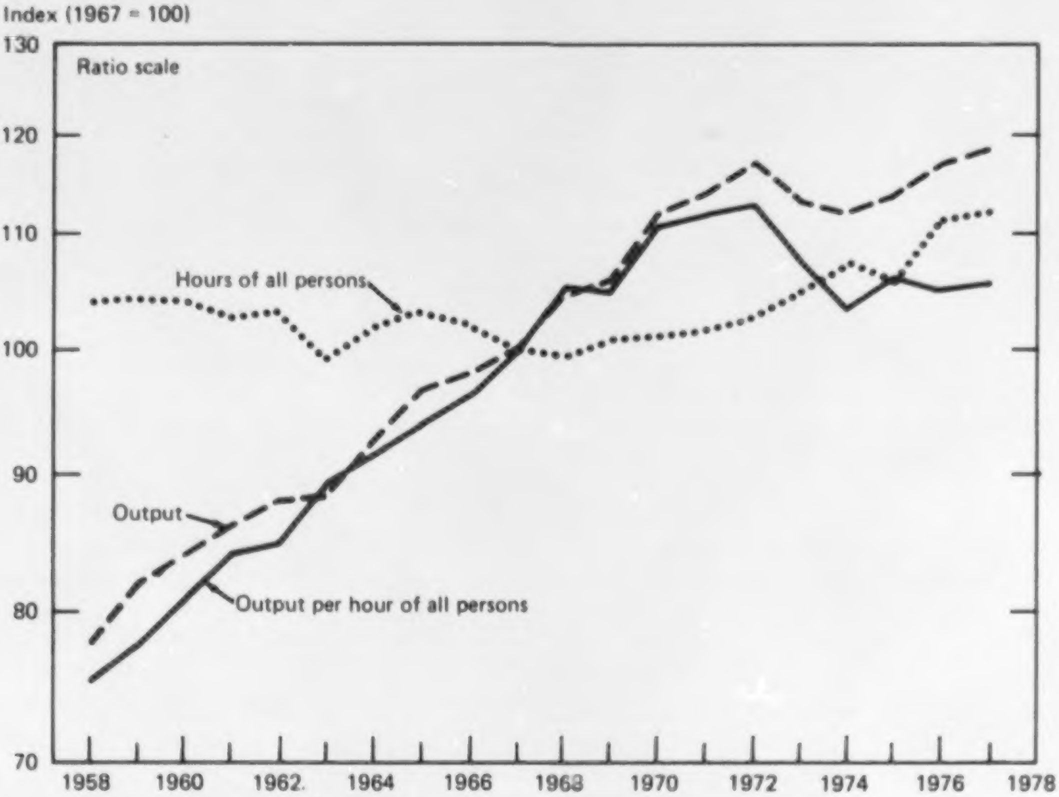
>> FOOD DISTRIBUTION <<

Americans spend approximately one-fifth of their disposable incomes on food, and productivity gains or losses in the food industry have a direct impact on the cost of living. Since 1972, however, productivity in retail food distribution has generally declined (see Chart 12). Although the recent upsurge in food prices is the result of many complex factors, both domestic and international, an improvement in the rate of productivity growth could relieve some inflationary pressures.

Productivity in Food Distribution

During the past several years, the Center and its predecessor Commission have been working to overcome barriers to improved productivity in the food industry. A 1973 study identified more than 40 opportunities for productivity improvement, ranging from increased consumption of quahog clams to the electronic checkout. Some of the study recommendations have been instituted by other Government

Chart 12
Retail Food Stores: Output Per Hour of All Persons and Related Data, 1958-77



Source: U.S. Department of Labor, Bureau of Labor Statistics

agencies; others by the food industry itself. As a result of the Center's efforts, the industry has begun discussing productivity.

One of the most important barriers to change is the industry's complex structure of growers, shippers, processors, wholesalers, and retail outlets. Each sector along the line has its own productivity problems, and there is little concern about possible cooperation with other units in the chain. The aggregate impact of inefficiencies is passed on to the consumer.

The Center concentrated on the barriers found in the distribution stage, which accounts for about 40 percent of the food dollar. The food distribution industry consists of thousands of individual firms, which transfer containers of food from one point to another. It has been estimated that before a package reaches a store shelf it has been physically moved from one place to another an average of 17 times.

The industry's productivity problem is complicated by fragmentation, by the vast differences in size and resources between the largest and smallest firms, by the great proliferation of product lines a store handles, and by the need for innovations to increase efficiency in operations.

A single food distributor can initiate only small, internal changes and cannot finance the cost of developing innovations. The industry has not been able to muster the degree of cooperation needed to make systemic changes, even though several productivity-enhancing innovations, such as modular packaging and pallets and intermodal shipping, are waiting in the wings. In these cases, however, unless everyone makes the change, no particular firm can benefit from changing. It appears that these innovations will not be applied without support from external forces, including Government.

Opportunities for Productivity Improvement

The Center has consulted with operators at every stage of the distribution chain, with labor and consumer groups, and with Government agencies to discover possibilities for productivity improvement. Substantial opportunities exist to improve efficiency in food distribution, but these changes will require management concern with productivity improvement and a greater degree of cooperation among the many elements of the industry.

Productivity Measurement

Both industry and government have long depended upon sales, square footage, and labor hours data to track industry performance for purposes of planning. The Center became concerned that in this industry, as in others, nationwide information may not be sufficiently detailed; there are significant differences in operating conditions from location to location. For this reason, the Center initiated a project to generate productivity data on a regional basis. These data would take into account the market (growing or diminishing), labor force, real estate, energy cost, and other factors in each region that might affect productivity. Preliminary results indicate that regional differences are so significant that productivity goals and results are more meaningful at that level.

A related effort has been to take commonly accepted productivity data that are used for various functions and departments at the firm level and create an information system that clearly demonstrates to a manager how productivity performance can affect his decisions. Although industry members often measure the sales per employee hour of produce and sales per square foot of space, information on overall productivity was inadequate to support major policy decisions.

Data Processing

Profitable food distribution derives essentially from the art of inventory and cash management. Enormous quantities of goods are processed through the system, and enormous amounts of cash pass through the stores. The greatest potential for improvement lies in the ability to be able always to give customers what they want, while minimizing inventory requirements. Success also depends on managing large cash flows very closely. With the advent of the Universal Product Code, mini-computers, and electronic scanning equipment, there exists enormous technological capability to improve the management of inventory and cash.

The Center and the industry held a major seminar on these and other technological opportunities, but adoption remains slow. To realize the inherent benefits these technologies offer, more managers will need to focus some attention on the "production" end of the business, rather than being totally absorbed in merchandising.

To help illustrate the extended benefits of electronic checkout and coded packaging, the Center commissioned a special study by Distribution Codes, Inc. to examine costs and benefits of coding cases of food (as well as individual packages) as part of an integrated management control system. Industry effort will determine final results.

Materials Handling

Food distribution is a massive logistical system. Millions upon millions of packages are prepared, stored, shipped, rerouted, received, and opened through processors, wholesalers, and retailers in warehouses, trucks, trains, and stores. The efficiency of the system depends partly upon how easily these packages can be handled and stacked.

Although the benefits of modular packaging (a limited number of uniform sizes and shapes) to the total productivity of the system have been known for years, there is still no uniformity in secondary packaging. Attaining this modularization, however, requires everyone to make the switch at the same time; no one player can change the system alone. Industry is seeking a way to work together to make the change.

A similar opportunity to make handling more efficient lies in a relatively simple technological change in the pallets that are used to ship perishables. The Center, in cooperation with the California Grape and Tree Fruit League, tested a new method of shipping produce. It involves using semirigid (plastic paper composite) "slip sheets" for storing cartons. They would replace hardwood pallets, which are heavy (adding up to 600 pounds of dead weight per truck load), bulky (one pallet occupies as much space as 50 slip sheets), and must be stored by the receiver and then reshipped to the sender at substantial cost. Using slip sheets would save an estimated $120 to $140 per trailer in transport costs. Again, however, innovations of this sort, to be effective, must be accepted by growers, shippers, distributors, and food chains. Several reports from the Center have emphasized the need for mutual acceptance and simultaneous application of technological change in food distribution, but it is apparent that concerted action requires continued Government encouragement and enlightened support.

Development and Diffusion of Innovation

Among the barriers to a faster pace of technological change in food distribution is the inability of individual firms to develop new technologies that might improve their efficiency and communicate to research engineers what the needs of the industry are. To bridge this gap, the Center, in cooperation with MIT and the University of Southern California, sponsored the Technology Applied to the Food Industry Program (TAFI). This was a series of meetings in which food store operators explained their technological needs in materials handling, information processing, food processing, refrigeration, energy use, and sanitation to research engineers from more advanced industries.

The engineers suggested innovations that might fill these needs; the list included new cutting methods (such as a laser beam to reduce waste in cutting operations), a simpler refrigeration system, and devices to reduce pilferage, among other improvements. This program represented a brief experiment in overcoming some of the risk of market failure that is inherent in the complex process of technological innovation, because it takes so long for a new technology to be developed and to pay off.

Another significant communication gap was found in the dissemination of research reports of the Agriculture Marketing Research Institute of the U.S. Department of Agriculture. A study for the Center reported that a substantial proportion of potential users of the Institute's research are not fully aware that the research results are available and that many who do know are skeptical toward, or ill equipped to implement, these results.

Inner City Food Distribution

One disturbing result of local productivity problems has been the closings of supermarkets within urban areas. Unable to devise methods to deliver food efficiently in these areas, stores have raised prices to the point of public outcry, lost money, or placed their investments elsewhere. Most often the last option is chosen, and stores are closing where they are needed.

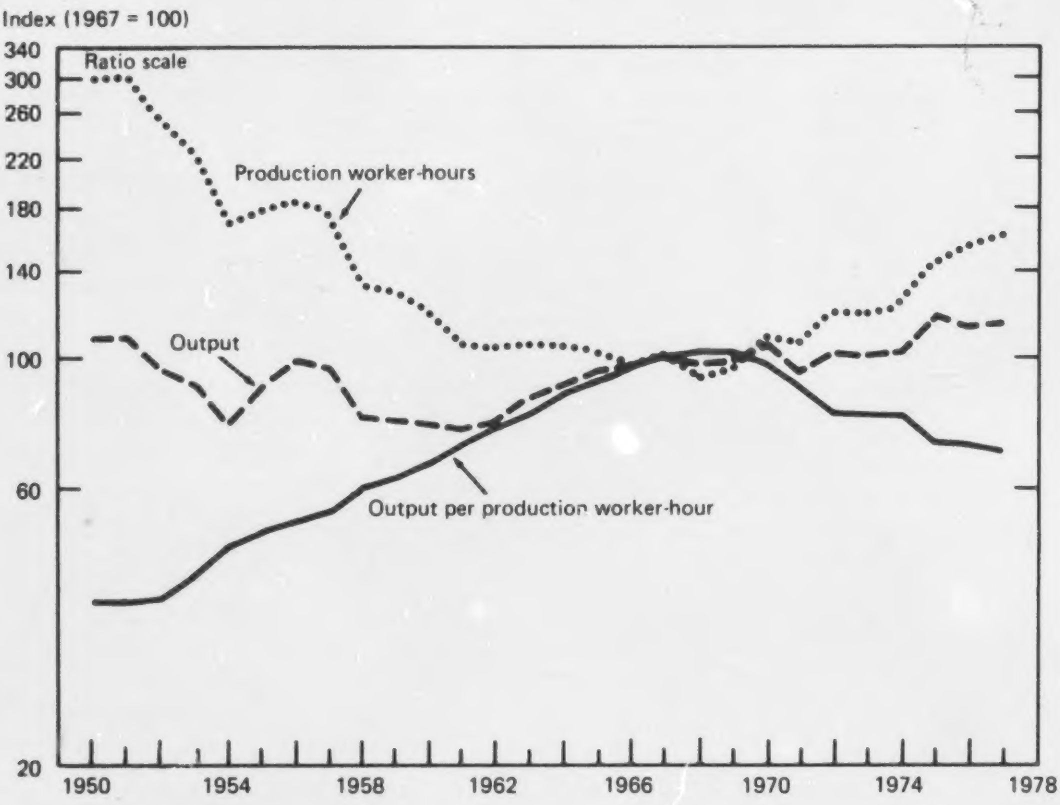
In a few locations, however, local communities, governments, and retail firms have established different, more productive arrangements for urban conditions. The Center hosted a conference to allow other local governments, firms, and community groups to hear the experiences of cities (Los Angeles, Chicago, Washington, D.C., and New York City) that have experimented with new methods for providing groceries to inner city residents.

>> COAL MINING <<

The coal mining industry in the United States is in a unique position: it is a reviving industry. The industry's output (bituminous and anthracite) amounted to 695 million tons in 1977--about 18 percent of world production, and the largest output in the postwar period (see Chart 13). In 1950, there were 9,400 mines, and by 1973, there were less than 5,000, but now the number has climbed again, to 6,500. Suddenly, coal has become a cornerstone of the U.S. energy position. Approximately 90 percent of all U.S. energy reserves are coal. To meet expectations of various energy plans, coal production would have to nearly double during the next 10 years.

The industry employs almost a quarter of a million workers, and it is a major source of employment in Appalachia. Although underground mining has been the traditional method of producing coal, surface mining now accounts for nearly 60 percent of production. Coal mining is a highly unionized activity, and the industry has a history of frequent, and sometimes violent, wildcat strikes.

Chart 13
Coal Mining: Output Per Production Worker-Hour and Related Data, 1950-77



Source: U.S. Department of Labor, Bureau of Labor Statistics

Productivity in Coal Mining

Unfortunately--given our need for domestic energy sources--the coal mining industry, since 1969, has had an unusual record of productivity performance. It is one of the few industries in which productivity actually has been dropping annually since 1969. This decline is the result of several factors:

- stringent new health, safety, and environmental regulations
- labor-management problems that have lead to repeated strikes
- a shortage of experienced workers, managers, and technicians
- changes in ore grade and operating conditions
- a slow rate of adoption of new technology

Our ability to improve coal mining productivity is critical, not only because we need to lower our dependence on imported oil, but also because the more dependent we are on coal, the greater the impact low productivity will have on inflation.

The coal energy system is a complex one. Coal must be mined, processed, transported, and transformed into energy by a burner of some sort. At this time, there is no element of the system that is particularly efficient:

--Productivity at the mining end is inhibited currently by a shortage of skilled supervisors; by poor labor-management communications; by mine safety and environmental regulations, which restrict operations; and by continuously changing conditions for extracting coal from a mine.

--The transportation of mined coal depends upon an unreliable rail system and a mostly nonexistent slurry pipeline network. The railroads, in the midst of existing problems in using their equipment efficiently, were caught short of hopper cars to meet the sudden demands for transporting more coal. Slurry pipelines sound efficient on paper, but the environmental and capital cost questions they raise have not yet been answered.

--At the utilization end, coal is only useful if it can be burned. Industry, for years, has built equipment to burn oil, now this equipment must be converted or replaced in order to use coal. This changeover is an expensive task, which cannot be completed rapidly.

Building a highly productive coal energy system will require a major effort by Government and others to understand the particular nuances of that system and then to develop a comprehensive plan for improving productivity at all stages.

Importance of Better Communication

The Center has focused its activities at the level of mine operations, in which productivity actually has declined. Cooperative discussion with managers and union officials has made it clear that the primary need at the present time is for improved communications throughout the industry; the paralyzing strikes of 1977-78 bear dramatic witness to this conclusion.

Coal mining is not a very stable process: the activities at each mine are different from those of other mines, and they change daily. Coal extraction is directed by a very sensitive set of communications. The system must be able to respond effectively to the changing depth and quality of coal in the mine and the conditions for bringing it out. This set of communications determines both the safety and the efficiency of the process as miners use their skills and the available technology to mine coal.

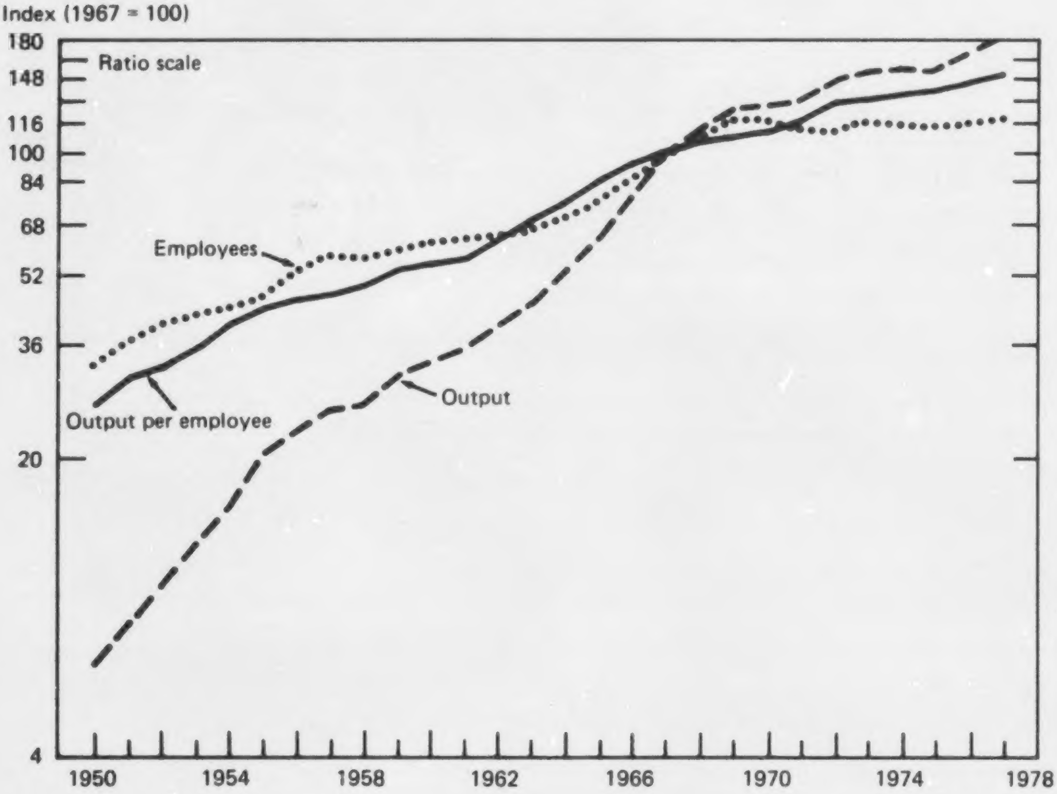
Communication is also essential to improving this process, and today, communications within the system are not very good. The Center has sponsored two programs to try to help improve them--one in the West (Utah) and one in the East (Pennsylvania/West Virginia). These programs are designed to generate productivity improvement ideas at the level of individual mine operations and expand them through the industry. The topics range from the technical elements of extraction, to the training of new mine workers, to living conditions in mining communities.

Finding ways to enlist all participants in the coal industry in making coal mining more efficient is a local/regional issue. The Center has found that effective problem solving at the local level, with the participation of labor, management, and Government, can help produce the changes necessary to improve productivity in the coal industry.

>> AIRLINES <<

The airlines industry has been among the country's top performers in its productivity growth. As Chart 14 shows, however, the rate of improvement has leveled off in recent years. In 1976, the Center's Transportation Committee selected a task force composed of representatives of management, labor, and Government to find reasons, and possible remedies, for this decline. The task force identified several factors that affect airline productivity: air traffic control systems, airport design, general use of air traffic facilities, sharing of equipment and facilitiies, intra-industry coordination and communication, labor-management communications, capital investment and R. & D., administrative services, and route award procedures and rulemaking.

Chart 14
Air Transportation: Output Per Employee and Related Data, 1950-77



Source: U.S. Department of Labor, Bureau of Labor Statistics

The task force first turned its close attention to improving revenue accounting procedures. Revenue accounting records the liability to provide transportation when tickets are sold, books revenues when transportation is provided, and settles revenue sharing between airlines when more than one line is used for a trip. This is an important function within the airlines; the 25 Air Transportation Association carriers employ 4,100 people for this purpose and handle an average of 5.3 million tickets a month. The cost of this function is increasing as the rapid growth in traffic volume compounds the complexities of the system and as the Civil Aeronautics Board expands its reporting requirements. The task force found that revenue accounting productivity could be improved in several ways:

--Reduce the size of the 10-percent sample (approximately 30.7 million coupons) that must be reported quarterly to the CAB for its passenger origin and destination survey.

--Improve sampling techniques so that all interline settlements can be made on the basis of samples; this would reduce the time required to audit, price, and bill online and interline settlements, and improve the accuracy and speed of settlements.

--Introduce a standardized online computer pricing system across the industry to speed up ticket pricing and allocate value by segment; by increasing the accuracy and credibility of samples, smaller sample sizes could be used without loss of confidence.

--Improve the format and physical standards of tickets. Inconsistencies among tickets and illegible and misplaced ticket entries cause as much as 25 percent of the total ticket load to be rejected by computers; these tickets must then be rerun or hand processed. Poor ticket stock and the red carbon backing also inhibit efficient processing.

--Introduce an independent interline settlement process, such as an airline clearinghouse, which would permit greater use of sampling, computers, and automation, and eliminate redundant auditing.

The task force recommended that the Economics and Finance Council of the Air Transport Association, through an industrywide effort, pursue methods of achieving these gains.

>> CONSTRUCTION <<

Productivity growth in the construction industry has a widespread effect on the entire economy. It affects the cost of housing, and business and industrial plant expansion and therefore influences the allocation of capital. Slow productivity growth in the construction industry has long been a concern. The seasonal and cyclical nature of construction compounds the industry's productivity problems, and economic pressures generated by inflation limit construction activity, which is particularly sensitive to high interest rates and rising land and material costs. No simple answers to productivity improvement have been found by industry or labor leaders, nor has a list of critical issues emerged which can be addressed systematically.

Part of the difficulty lies in the enormous size and diversity of the industry: it employs 5.4 million workers and accounts for 10 percent of the gross national product, but it is highly fragmented among a multitude of contractors, construction firms, trade and professional associations, supply companies, labor organizations, and government regulators. The Center found that the industry's structure, which hinders the transmission of new ideas, is one of the most serious obstacles to improving construction productivity. The geographical dispersion of the industry limits lateral communication, but even within a single geographical area, communication is discouraged because firms differ widely in size and character--from the three-houses-per-year builder to the power plant contractor. The separate professional interests of architects, engineers, lawyers, bankers, and the public officials, and the many distinct trades among construction craftsmen isolate people and ideas. Regulatory issues regarding the environment and equal employment, superprojects, and "merit" shop lead to a short term "political action" perspective, sharpening differences among the groups in the industry and obscuring longer term common interests.

To explore the possibilities for greater cooperation, the Center met with representatives of labor, management, users, government, and designers to consider an agenda for productivity improvement. These meetings and discussions led to the following conclusions:

- The greatest potential for productivity improvement lies not in the area of increased capital and technology, but rather in the area of increased communications and information.
- To enhance the communication of productivity information, all elements of the industry--management, labor, designers, regulators, owners, financers, suppliers, and academics--should be invited to participate in a search for exemplary construction practices.
- The Federal Government could help foster the creation of a central productivity forum that would provide the basis for such a cooperative industry undertaking.
- The development of useful measurement techniques would help identify common productivity problems.
- Research and development and study of exemplary practices are needed to discover solutions to productivity.
- Solutions should be communicated to the industry at large, especially at the local level, in order to promote increased cooperation among management, labor,

owners, designers, regulators, and academics, which would improve construction productivity.

Measuring Productivity

Because objective information about the factors that determine productivity could be the basis of meaningful discussions of improvement, the Center concentrated on investigating various aspects of productivity measurement. The concept of productivity in construction is not only a quantitative measure of the number of employee-hours per physical unit of output, it also measures the quality of the workmanship. Construction productivity is influenced by design, equipment, capital, and management, as well as labor effort and skill.

A study for the Center analyzed productivity measurement from 15 different points of view, from the macroeconomy level to the construction site and operations level. At each level, different measures are relevant, and each is useful for different purposes. The matrix of measures that was developed provides a conceptual framework for clarifying the various types of measures and their interrelationships.

Another approach to understanding construction productivity used a computer simulation model to analyze the relations of changes in the economy and changes in construction. The MIT National Model helps to trace the long growth wave of construction of capital plant beginning after World War II and now nearing a peak. If sufficient plant is available to meet production needs, then capital construction may fall. Lower demand, coupled with excess construction capacity, may tend to lower overall construction productivity.

A third approach deals with analysis and measurement of productivity in maintenance and repair work. In conjunction with the U.S. Air Force, the Center is studying factors affecting productivity in order to develop better methods of problem solving for supervisors and foremen in this important function.

Comprehensive Problem Solving

The construction industry needs to develop not only a means to measure productivity but also a means to solve identifiable problems. There is no central storehouse of shared information on exemplary practices, solutions to specific productivity problems, or current research projects.

For this reason, construction research and development appears to lag that of other industries. Actually, each construction firm continually pioneers innovations of all kinds, and in general, equipment, material, and technological innovations are developing faster than most companies can use them. The lag is in process innovation--the spread of new ideas for improving the management and means of construction.

To encourage new ideas about how to increase research and development of construction processes, the Center sponsored, with NSF and many others, a 3-day conference on research applied to construction productivity. The conference produced many suggestions for study areas, including

- a resource allocation system to insure that materials, labor, and financing flow in proper sequence and quantity
- the inter-relationship of design, owner interests, and labor
- the impact on productivity of costs of all kinds, particularly recordkeeping requirements for both internal and governmental purposes
- the need and the procedures for industry input into the regulatory process
- the possibility of requiring an "impact" statement before new regulations are implemented
- job-site applications of research
- predesign estimates, product efficiency, and contract constraints imposed by design
- management control systems, management organization, and incentives to improve productivity

Creating an industry forum to oversee process innovation remains an unfinished task.

The Center, working with the Department of Civil Engineering at MIT, is examining the feasibility of increasing information flows about performance at the job site. The concept, called a cooperative control system, would more fully involve all construction participants in a feedback information network so that each would have a clearer stake in seeing a job go well. The potential for avoiding problems, for measuring progress, and for sharing the rewards for improved performance is considerable, but managers may hesitate to measure their own productivity performance and to share with labor all productivity measures. In the competitive world of contract construction, such information is normally a closely guarded secret.

Labor Management Cooperation

Developing a better understanding of construction productivity may be useless unless the industry, particularly labor and management, is willing to cooperate to apply the new knowledge to improve performance. One Center project, a study on construction labor-management committees in six cities, has investigated the potential for such cooperation. Most of the participants in these committees strongly believe that the communication links they have forged have had substantial effect in improving construction productivity in their cities. Bringing such examples of labor-management cooperation into the mainstream of industry discussion appears to be an important task and a step toward sharing the growing body of experiences with cooperative efforts.

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AN AGENDA FOR NATIONAL ACTION

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THE CENTER'S EXPERIENCE during the past 3 years in working with labor, management, government, and other groups has provided a unique vantage point from which to view the paths toward higher productivity. There are many obstacles along the way and few short cuts, but the potential rewards are great. We urgently need a national productivity effort which can help overcome some of the problems and guide us toward the opportunities ahead. This national effort should draw upon the contributions and experiences of all groups of society, and it should proceed on many fronts, for there is no simple, dominant source of productivity growth.

The Center's Agenda for National Action suggests measures that could help improve the Nation's productivity performance. Carrying out these measures will require adjusting some of our present policies toward technological innovation, capital requirements, human resources, government-business relationships, and other factors. If new policies are to have practical results, however, they must take into account the specific problems of individual industries.

The agenda that follows is not a priority list; rather, it itemizes the areas that need attention now if we are to reverse the present downward course of the rate of productivity improvement.

>> I. EXERCISE NATIONAL LEADERSHIP <<

Sustaining a national effort to improve productivity performance requires leadership that only the Federal Government can supply. Productivity growth has been achieved primarily as a result of private initiatives taken for private economic benefit. In our mixed and interdependent economy, however, few efforts are exclusively private; the Government plays an important supportive role:

setting the framework for private enterprise, providing information, assisting research, encouraging capital investment, and funding education and training.

Although our economy is designed to work primarily through private actions, they cannot, in all cases, realize adequate gains for the Nation as a whole. Private incentives are not always appropriate or strong enough to accomplish national goals, and sometimes the working of the private market is hampered or distorted by Government regulations and procedures. To see that the economy operates to benefit the entire Nation, we need policies--and appropriate actions--to direct and supplement private efforts.

>>>>ACTION PROPOSALS:

Establish an independent organization as a focal point for productivity improvement activities. This organization should perform the following functions:

- Provide information about productivity-enhancing programs and the benefits of higher productivity, and inspire leaders in the private and public sectors to set higher productivity as an important goal; an informed and understanding public is essential to rational decisionmaking.
- Advise the Government on its policies affecting productivity and--when national choices must be made--act as advocate for policies that will improve productivity.
- Provide opportunities for representatives of labor, business, and all levels of government to discuss constructively problems in which they have a common interest; the purpose of these discussions should be to promote understanding and increase the possibility of cooperative actions.
- Coordinate and act as clearinghouse for the many activities of Federal agencies that affect productivity, and provide the public with a guide to these activities; Federal efficiency requires that programs of different agencies be reinforcing rather than conflicting or overlapping and that the benefits of these programs be transferred to the private sector.

Support and reinforce newly emerging State and local counterpart efforts to seek productivity gains.

With the National Center's assistance and encouragement, productivity and quality of working life centers and institutes have already been established in Utah, Maryland, Massachusetts, Illinois, Pennsylvania, and Arizona, and others are forming. These organizations provide small business and labor with information, technical assistance, and training on ways to improve productivity and life on the job. A national body, capable of providing continued encouragement, support, and technical assistance, could enhance the ability of local centers to contribute to community and national goals. A network of State and local productivity centers would constitute a truly national movement that could help upgrade the performance of small- and middle-size enterprises throughout the country.

>> II. ASSIST INDUSTRYWIDE EFFORTS TO IMPROVE PRODUCTIVITY <<

Opportunities to make changes that will improve productivity differ from industry to industry. Where these opportunities lie and how to act upon them can be best determined by people--managers, workers, suppliers, and customers--in each industry. The Government can provide a forum for their deliberations and assist them in solving problems. In many industries, important opportunities lie beyond the reach of individual action and require cooperation among business, labor, and government.

Productivity improvement programs cannot be developed by government order, but the Center's experience in acting as catalyst for industry efforts has been encouraging. Mutual trust and a climate for cooperative problem solving take time to emerge and require knowledgeable assistance from a source in whom the parties have confidence.

>>>>ACTION PROPOSALS:

Encourage formation, on a voluntary basis, of industry-labor-government task forces in older, distressed, and endangered industries to formulate comprehensive programs to address problems underlying productivity growth.

Coordinate the needs of these industries with existing Government programs that can provide assistance in particular aspects of an industry's productivity problems.

>> III. ENCOURAGE LABOR-MANAGEMENT COOPERATION <<

There is increasing evidence that in-plant labor-management consultative committees, created through collective bargaining agreements, can be a useful mechanism for drawing on the ideas and knowledge of the work force to improve the work environment; often this joint involvement can produce gains in productive efficiency as well. The decision to undertake cooperative efforts must rest with a firm's or plant's management and workers. No outside force can overcome the traditional fears and mistrust between labor and management and impose a problem-solving approach to mutual concerns.

The reasons for adopting cooperative techniques seem to be mounting. The threat of foreign competition, interest in reducing absenteeism, grievances, and strikes, and the energy crisis, encourage interest in cooperation for mutual survival. Many unions and managers have cooperated on such issues as training, alcoholism, safety and health, drug abuse, pensions, and retirement, but so far relatively few cooperate on work improvement or quality of working life projects. Clearly, many more opportunities exist. The area for cooperation is vast, but as yet it is largely unexplored.

The Federal Government plays a limited, but useful, role in trying to en courage greater cooperation between management and labor. It provides mediation and conciliation services, information, and research. As an employer, itself, it has experimented on a limited basis with quality of work life projects.

>>>>ACTION PROPOSALS:

Provide interested parties with information about labor-management cooperation and quality of worklife innovations of merit and support technical assistance and training in mutual problem solving.

This action would primarily be carried out by nonprofit productivity and quality of working life centers through workshops, conferences, and publications.

Encourage and support communitywide labor-management councils which have as an objective integrated educational and developmental programs for in-plant committees.

Support research on workers' expectations, quality of working life, and emerging problems in the workplace.

This research should include empirical studies of absenteeism, shift work, and new arrangements of working hours.

Issue an explicit policy declaration on the importance of joint consultation and cooperation on the improvement of productivity and the quality of working life.

Encourage the training of third parties who, as educators, mediators, sources of information, and in other facilitator roles, can assist joint committees to form and function effectively.

Study, as an employer, the feasibility, benefits, and problems of joint labor-management cooperation in Government; and test, as an example to the private sector, the concept of mutual effort to improve the quality of worklife.

>> IV. ENCOURAGE MANPOWER PLANNING <<

The climate for productivity improvement efforts could be enhanced if higher productivity were not seen as a threat to job security. Although productivity improvement is often the enabling factor in a firm's competitiveness and long-run viability, employees' fear of displacement, especially in periods of uncertainty and in declining industries, is pervasive.

Firms that plan for human adjustment to technological change can reduce personal hardship and encourage cooperation, even though productivity increases. Manpower planning involves estimating future labor requirements and skill needs and developing programs for retraining, reassignment, and retirement of employees whose jobs are eliminated. Allowing employment levels to adjust by attrition can obviate the personal hardships, waste of human skills, and cost to the economy that result from displacement and unemployment. Because firms benefit from productivity gains, they should be encouraged to use some of these gains to provide orderly adjustments for those who may be adversely affected.

>>>>ACTION PROPOSALS:

Provide information on the costs and benefits of measures such as retraining, relocation, early retirement, severance pay, work sharing, and educational leave, which would cushion the individual impacts of productivity improvement.

Provide technical assistance to parties who wish to plan programs to stabilize long-run employment and to reduce seasonal and cyclical fluctuations in employment.

Develop measures to coordinate private adjustment measures, such as supplementary unemployment benefits and early retirement, with public programs--unemployment compensation and social security.

Encourage training programs to reduce any shortages of skilled technicians which could create bottlenecks in the diffusion of new technology.

>> V. FOSTER TECHNOLOGICAL INNOVATION <<

Concern about the productivity slowdown has renewed interest in measures to strengthen the advance of American technology. Disturbing signs of slippage in U.S. technological leadership have prompted increased Federal support of basic and applied R. & D, the formation of a Presidential Task Force for Domestic Policy Review on Industrial Innovation, and proposals for a Cooperative Technology Program in the Department of Commerce to improve the infratechnology of small, distressed industries.

There is wide agreement that from the perspective of productivity improvement a major bottleneck lies, not in the generation of new technology, but in its slow rate of diffusion and implementation throughout industry. There are serious shortcomings in the management of the technological innovation process by firms and by governments. Closer cooperation among industry, universities, and Government, better incentives to develop new ideas, and the fostering of longer time perspectives for American managers could help encourage the adoption of technological innovations.

>>>>ACTION PROPOSALS:

Encourage engineering schools, Government, and industry to cooperate more closely through exchanges, conferences, workshops, internships, and training courses on advanced manufacturing technologies and the innovation process.

Assist equipment producers by gathering information about the market for innovative technology and user requirements for new technology.

Require government procurement agencies to use, as far as possible, specifications which would encourage technological innovation.

Develop the concept of a technology demonstration center, not connected with particular vendors, to train small firms in managing, justifying, programming, operating, and maintaining automated equipment.

Encourage U.S. engineers and managers to capitalize on scientific and technological advances developed in other parts of the world through study tours, translations, and plant visits.

>> VI. SUPPORT INCREASED CAPITAL FORMATION <<

An increased rate of capital investment would promote economic recovery and modernization and expansion of plant and equipment and help avoid the shortages of key materials that have hampered production in the past. Over the long run, a faster growth rate in the capital/labor ratio would bring about a higher rate of productivity growth.

There are no clear explanations of why a low rate of capital investment persists and no broad consensus about measures to increase the rate of capital formation. There is agreement that the Administration's program to reduce inflation and over-regulation could contribute to a better climate for investment, as could the Administration's proposals reduce the corporate tax rate, to make permanent the 10 percent investment tax credit, and to liberalize depreciation allowances for small business.

>>>>ACTION PROPOSALS:

Consider ways of accelerating depreciation on major innovative projects, such as allowing depreciation to start as soon as the investment is made and providing faster write-offs for first adopters.

Encourage small venture capital enterprises, which have contributed importantly to technological innovation.

Study whether employee stock ownership plans can be better organized to contribute to capital formation and productivity.

Stimulate productivity improvement in building construction and other capital goods industries in order to help reduce the relative price of capital and thereby increase investment in various sectors of the economy.

>> VII. REFORM THE REGULATORY SYSTEM <<

Reducing the inhibiting effects of regulation on investment, innovation, and productivity, without diluting environmental, health, and other sound objectives, is now widely accepted as a goal of public policy. In some cases, deregulation, or less regulation, can free enterprise from unnecessary and outworn rules and increase competition. In most cases, regulatory reform could simplify compliance procedures. The overall costs of regulation could probably be reduced by a greater awareness that the pace at which regulations are applied partially determines the magnitude of the burden.

Executive Order 12044, a significant new direction in regulatory reform, requires "careful examination of alternative approaches early in the decision-making process," and the Regulatory Analysis Review Group helps to introduce productivity considerations in rulemaking. These initiatives could lead to the use of incentive systems that would reduce the costs and the productivity-inhibiting effects of regulation.

>>>>ACTION PROPOSALS:

Develop regulations in consultation with the parties who will be affected by them.

Place greater emphasis on achieving compliance through consultation, rather than through threats of legal action.

Improve the coordination of reporting requirements of regulatory agencies, and reduce the number of overlapping jurisdictions.

Provide for Congressional review of regulatory standards on which no consensus among regulators, industry and the public can be reached after a reasonable length of time.

>> VIII. IMPROVE PUBLIC SECTOR MANAGEMENT <<

All levels of government need better management if they are to achieve productivity improvement. Raising public service productivity will require strong commitment from the top leaders of government to the goal of efficiency, as well as attractive incentives and rewards for performance and skill training. When accountability for productivity improvement is fixed and made an integral part of the management system, significant improvement can be achieved.

>>>>ACTION PROPOSALS:

Use the $80 billion intergovernmental grant system to encourage better management of federally assisted State and local programs.

Expand the Federal Intergovernmental Personnel Program to improve managerial skills at the Federal, State, and local levels of government.

Support modernization of financial and accounting systems to deal more constructively with capital budgeting.

Encourage labor-management cooperation in government through joint councils to deal with productivity and quality of working life issues.

>> IX. IMPROVE PRODUCTIVITY MEASUREMENT <<

Informed policymaking requires understanding the relevant facts and the interrelationships among these facts. Some of the relevant facts about productivity are unknown at present, and some are not very reliable. Our understanding of productivity needs to be based on reliable and extensive quantitative measures of trends in the economy, in industries, and in plants, and on comparative data for other countries. The National Academy of Sciences' comprehensive review of the concepts, measures, and gaps in productivity statistics will provide a basis for improving the factual understanding upon which national productivity policy must be built.

>>>>ACTION PROPOSALS:

Develop a family of productivity measures, which would relate output to inputs of energy, materials, and capital, in addition to labor.

Measure productivity in services and other industries, such as State and local governments, that are not now covered by BLS productivity statistics.

Expand data on international comparisons of trends and levels of productivity to cover individual industries.

Use workshops and publications to teach and encourage managers to measure productivity at the plant level in order to motivate productivity improvement and to monitor progress toward higher productivity.

>> X. CREATE AWARENESS OF THE IMPORTANCE OF PRODUCTIVITY <<

All of these actions the Center recommends are underway to some extent in the United States today. They represent the beginning of changes that must take place if we expect our economic system to continue to deliver constant improvements in our quality of life.

What is missing from these embryonic activities is a broad understanding of the need for, and the interdependence of, each action that affects productivity. The American economy is clearly in need of goals--not goals for distributing the benefits of a healthy expanding economy, but goals for achieving that state. These goals must emanate from management and labor leaders from each industry and sector. Once established, these collective goals will allow us to achieve a critical mass of activity in each of the agenda areas.

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APPENDIX B. PUBLICATIONS OF THE NATIONAL CENTER FOR PRODUCTIVITY AND QUALITY OF WORKING LIFE

ANNUAL REPORTS

Productivity in the Changing World of the 1980's: The Final Report of the National Center for Productivity and Quality of Working Life. 1978. Available from GPO.

Annual Report to the President and Congress of the National Center for Productivity and Quality of Working Life. 1977. GPO #052-003-00519-1, $3.25.

Annual Report to the President and Congress of the National Center for Productivity and Quality of Working Life. 1976. GPO #052-003-00336-8, $1.80.

Fourth Annual Report of the National Commission on Productivity and Work Quality. 1975. GPO #040-000-0034-7, $1.45.

Third Annual Report of the National Commission on Productivity. 1974. GPO, no stock number, $1.30.

Second Annual Report of the National Commission on Productivity. 1973. NTIS #PB263234/AS, $5.50.

First Annual Report of the National Commission on Productivity. 1972. NTIS #PB 263233, $5.50.

ECONOMIC BACKGROUND

Productivity Growth: Purpose, Process, Prospects, and Policy. 1978. Available from the Joint Economic Committee of the Congress of the United States.

Prepared by Dr. Solomon Fabricant and submitted as part of his testimony before the Joint Economic Committee of the Congress on June 8, 1978. Provides an historical overview of productivity growth and fluctuations in the United States, examines the process by which productivity changes, and considers the prospect of productivity growth. Also discusses the broad range of policies for improving productivity and why national policies must allow for the specific problems of individual industries.

Note: GPO = Government Printing Office; NTIS = National Technical Information Service of the U.S. Department of Commerce.

The Future of Productivity. 1977. GPO #052-003-00524-7, $3.00.
A Summary of the Future of Productivity. 1977. Also available from GPO.

The outlook for productivity growth in the United States and abroad as seen by leading economists and productivity experts. Presents eight papers (and summary) prepared for a conference sponsored by the National Center for Productivity and Quality of Working Life, the Council on International Economic Policy, and the RANN Program of the National Science Foundation.

A National Policy for Productivity Improvement. 1975. Available from GPO.

A statement by the National Commission on Productivity and Work Quality on national productivity policy. Designed to be the basis for future efforts of its successor, the National Center for Productivity and Quality of Working Life.

The Role of Productivity in Controlling Inflation. 1974. NTIS #PB283891, $4.50.

Study paper on the causes of current inflation. Includes a sector-by-sector analysis of the favorable impact of increased productivity on rising prices and the general health of the economy.

Conference on an Agenda for Economic Research on Productivity. 1973. GPO #4000-00301, $1.05.

Scholarly appraisals of what economic research can do to broaden knowledge of productivity measurement and growth and of the impact of cyclical variation and productivity change. Reviews knowledge, major gaps, and research priorities in various areas.

GENERAL INFORMATION

Directory of Productivity and Quality of Working Life Centers. 1978. Available from GPO.

Lists U.S. productivity and quality of working life centers, with addresses, phone numbers, names of key staff, type of organization, objectives, programs, publications, and other pertinent information. Also lists names, addresses, and directors of foreign productivity centers.

Productivity: Information Resource Directory. 1977. NTIS #PB282745/AS, $6.00.

Resources for productivity research and sources of productivity and worklife information, including institutions, organizations, publications and bibliographies, research and technical services, specialized guides, indexes and abstracts, automated data bases and services, and sources of audiovisual aids. Designed to assist labor, management, and the public at large in the easy retrieval of this information.

Productivity Centers Around the World. 1975. Available from NTIS.

Describes objectives, functions, and operations of major productivity centers, including members of the European Association of National Productivity Centers (Belgium, Bulgaria, Czechoslovakia, Denmark, France, West Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxemburg, the Netherlands, Norway, Portugal, Spain, Turkey, and Yugoslavia) and South Africa. Suggests reasons for their continued growth and influence.

PUBLIC SECTOR

Improving Productivity: A Self Audit and Guide for Federal Executives and Managers. 1978. Available from GPO.

Handbook for Federal executives and managers on how to deal with productivity issues. Assumes an awareness of the necessity for and desire to achieve greater efficiency and effectiveness. Designed to help build productivity improvement into the management process by helping managers to determine where they are, where they want to be, and how to get there.

Total Performance Management: Some Pointers for Action. 1978. Available from GPO.

Describes TPM, a method for measuring not only the productivity of public agencies in traditional, quantitative terms, but also in terms of how satisfied employees are with their jobs and how satisfied citizens are with the services public agencies provide. TPM involves employees in a bottom-up effort to solve problems and eliminate shortcomings. The objective is a more effective work force which delivers better services to the community.

Employee Attitudes and Productivity Differences Between the Public and Private Sector. 1978. Available from GPO.

A comparative analysis of public and private sector employee attitudes on factors affecting their work and the effectiveness of their organizations. Based on past demonstrations of the positive correlation between an employee's perception of an organization's performance and the actual performance of that organization. Identifies areas of potential interest to public sector managers and employees.

Improving Governmental Productivity: Case Studies. 1977. GPO #052-003-00352-8, $2.20.

Case studies of diverse efforts by city, county, and State governments to improve productivity. Describes how some officials approached productivity improvement, found and/or organized their resources (people), and achieved or failed to achieve their objectives in the complex environment of public services.

Managing Inspections for Greater Productivity. 1977. GPO #052-003-00345-7, $1.40.

Offers inspection managers and analytical staff practical ideas which can be modified and adapted to specific local situations and used in supplementing their own efforts at productivity improvement. The report resulted from a conference on improving productivity in inspection services.

Guide to Productivity Improvement Projects. 1976. GPO #052-003-00181-1, $2.10.

Prepared by the International City Management Association. Demonstrates many and various approaches and techniques used by local governments to improve productivity. Organized by functions, such as energy conservation, general administration, inspections, parks and recreation, public safety, public works, etc.

Employee Incentives to Improve State and Local Government Productivity. 1975. GPO #052-003-00090, $3.05.

Describes different employee incentive programs used by State and local governments. Reviews a sampling of these programs and offers guidelines on their implementation.

Labor-Management Committees in the Public Sector: Experiences of Eight Committees. 1975. Available from GPO.

A guide to initiating labor-management committees in the public sector to improve employee morale and productivity. The eight joint committees which are described are in local governments and Federal agencies.

Improving Municipal Productivity: Work Measurement for Better Management. 1975. Available from GPO.

An aid for managers and staff analysts in understanding concepts and application of work measurement techniques. Describes uses and benefits of these techniques in municipal functions and illustrates how they have enhanced local government productivity.

The Status of Productivity Measurement in State Government: An Initial Examination. 1975. NTIS #SHR0000422/LLC, $10.75.

The first survey made of the perception of State budget officers of productivity and effectiveness measures. Examines the adequacy of productivity information available regularly to public officials.

So, Mr. Mayor, You Want to Improve Productivity. 1974. GPO #5203-00049, $1.25.

Guidelines for the chief executive of any government entity for implementing a productivity improvement program. Covers union participation and public understanding. Describes an approach to obtaining and organizing the analytical resources required to realize the full potential of a productivity improvement program.

Improving Municipal Productivity: The Detroit Refuse Collection Incentive Plan. 1974. NTIS #PB283894, $4.50.

Describes an experimental productivity bonus system for sanitation workers. The plan provides for sharing of the savings gained through productivity improvements between the city and the employees.

Improving Productivity in Solid Waste Collection: A Brief for Elected Officials. 1973. GPO #052-00081-4, $.50.

How elected officials can assess the productivity of residential solid waste collection systems. Identifies improvement techniques tried in selected jurisdictions.

Opportunities for Improving Productivity in Solid Waste Collection. 1973. Available from GPO.

Report of the Solid Waste Management Advisory Group. Identifies common problems affecting residential solid waste collection systems and offers suggestions for improving and measuring the productivity of this function.

Improving Police Productivity: A Brief for Elected Officials. 1973. Available from GPO.

Subtitled More for Your Law Enforcement Dollar. How elected officials can assess the productivity of police services. Identifies improvement techniques tried in selected jurisdictions.

Opportunities for Improving Productivity in Police Services. 1973. NTIS #PB282030/AS, $6.00.

Report of the Advisory Group on Productivity in Law Enforcement. Identifies productivity-related issues within patrol, crime prevention, and human resources; explores the potential for more precise measures; and provides examples of improvement techniques.

The Wingspread Conference: Productivity in State and Local Government. 1973. Available from NTIS.

Identifies major barriers to improving productivity in State and local government as viewed by 50 key governors, mayors, city managers, and county executives.

Improving Productivity and Productivity Measurement in Local Governments. 1971. Available from GPO.

Wide variations in the basic costs of running local governments indicate that some localities are using more effective methods than others to provide services at lower costs.

INDUSTRY

Measuring Productivity in the Construction Industry. 1975. Available from GPO.

The views of influential industry, government, and academic authorities. Isolates factors affecting productivity in various segments of the construction industry. Suggests possible solutions to problems of measuring productivity in so diversified a sector of the economy.

Keeping Railroads on Track. 1975. GPO #052-003-00079, $.55.

Based on Improving Railroad Productivity, the final report of the Task Force on Railroad Productivity. Suggests innovations in corporate structures and freight handling procedures to improve service and make the railroads run profitably without large infusions of new capital or public monies.

Improving Railroad Productivity. 1973. NTIS #PB282980/AS, $12.50.

Final report of the Task Force on Railroad Productivity. Concerned with railroads as transporters of freight. Considers some actions the Federal Government might take in concert with the industry to make the Nation's railroads once more efficient, competitive, and profitable.

Backhaul in Food Distribution. 1975. Available from GPO.

Describes backhauling--permitting trucks to carry profitable loads on return trips--which could eliminate waste and increase productivity. Up to $100 million in annual savings could accrue from more efficient scheduling of the trucks used to transport processed foods.

Productivity in the Food Industry. 1973. Available from GPO.

Summary of the report by the Food Industry Task Force. Suggests that the many opportunities for productivity increases can be realized only through the concerted efforts of all segments of the industry.

Productivity in the Fishing Industries. 1973. Available from GPO.

Based on the report by the Seafood Panel of the Food Industry Task Force. Outlines barriers to and opportunities for improving production and productivity of the U.S. fishing industry.

TECHNOLOGY AND MANAGEMENT

New Technologies and Training in Metalworking. 1978. Available from GPO.

Reviews the role of technological factors and the training required to adapt to new technologies in metalworking, an economically critical area because of the metalworking sector's significance to other manufacturing industries; the apparent lag in introducing numerically controlled machines in the United States;

and potentially impressive productivity gains through a large-scale shift to newer technologies. Contains four case studies.

Improving Productivity Through Industry and Company Measurement. Series 1. 1975. Available from GPO.

Describes programs in five companies chosen from different industries for diversity in size and type of operation. Covers how productivity efforts were organized and what was accomplished.

Improving Productivity Through Industry and Company Measurement. Series 2. 1976. GPO #040-000-00372-0, $1.45.

Includes papers given at a seminar for trade and professional association executives. Covers productivity measurement in companies, industries, warehousing, and research. Also describes a Canadian experience.

REGULATION

The Uniform Tire Grading System: A Case Study of the Government Regulatory Process. 1978. Available from GPO.

Describes an apparent failure of regulation to set tire quality standards. Demonstrates how the same regulatory process worked quickly and effectively when safety was involved but was unable to resolve the quality issue. Suggests that the system breaks down and adversely affects productivity when it attempts to deal with issues which do not merit regulation and industry effort.

Synopsis of a Methodological Approach for Use in Assessing Impact of Government Regulation of the Steel Industry. 1978. Available from GPO.

Describes the potential benefits in reaching effective regulatory decisions which could result from a well-constructed industry study; provides insights into how previous studies tried to document the impact of EPA, OSHA, and other regulations on the steel industry; and suggests the criteria and requirements of a sound methodology for an industry study.

LABOR-MANAGEMENT COMMITTEES

Starting a Labor-Management Committee in Your Organization: Some Pointers for Action. 1978. GPO #052-003-00559-0, $2.30.

Guide for labor and management representatives in establishing joint committees in plants and companies. Discusses how committees are formed to foster greater cooperation through an open exchange of ideas outside the formal collective bargaining process and in a nonadversary environment.

Establishing a Communitywide Labor-Management Committee. 1978. GPO #052-003-00564-6, $1.70.

Guide for communities or geographical areas in establishing labor-management committees or councils to retain, strengthen, and expand existing industry and bolster the employment base. Describes experiences of selected communities in forming and operating such committees.

Recent Initiatives in Labor-Management Cooperation. Volume I, 1976, NTIS #PB281704/AS, $6.00. Volume II, 1978, GPO #052-003-00554-9, $2.75.

Based on case histories of labor-management committees and discussions from a series of conferences on recent initiatives. Participating were workers and managers involved in cooperative activities. Describes practical day-to-day experiences in starting committees and examines benefits from and problems associated with cooperative efforts.

A Summary of the Role of Third Parties in Labor-Management Cooperative Endeavors. 1978. GPO #052-003-00558-1, $2.20.

A review in "operational" terms of the evolving participation by independent third parties in cooperative endeavors, such as developing new programs, activities, or practices, or in exploring future contract provisions. Describes how third parties can encourage a problem-solving process between labor and management which accommodates both parallel and opposing interests.

Directory of Labor-Management Committees, Second Edition, 1978. GPO #052-003-00522-1, $4.00.

Describes 215 joint committees in companies, plants, industries, geographical areas, the public sector, and those set up under the Scanlon Plan or other gains-sharing plans. Includes data on employers and unions, founding dates, contract obligations, and issues covered. Three indexes--by type of committee, companies, and unions.

A Plant-Wide Productivity Plan in Action: Three Years of Experience with the Scanlon Plan. 1975. Available from GPO.

Describes the Scanlon Plan and its impact on productivity at DeSoto, Inc., a large manufacturer of paint, over a three-year period. Results showed productivity gains as high as 41 percent, and high levels of satisfaction with the plan on the part of both management and workers. Factors affecting worker acceptance of the plan are analyzed.

Labor-Management Productivity Committees in American Industry. 1975. Available from GPO.

Reviews the limited U.S. experience with joint labor-management committees in dealing with production and related problems. Traces committees set up in the 1920's and 1930's, the World War II and postwar experience with the Scanlon Plan and committees in government, and recent initiatives in basic steel, retail food, trucking, railroads, and other areas.

Labor-Management Committees in the Public Sector: Experiences of Eight Committees. (See PUBLIC SECTOR, above.)

Employment Security and Plant Productivity Committees in the Steel Industry. 1974. Available from GPO.

A presentation by I. W. Abel, former President, United Steelworkers of America, and former board member of the National Center for Productivity and Quality of Working Life. Describes labor and management experiences in the steel industry with the Employment Security and Plant Productivity Committees which raised productivity levels and provided the foundation for the historic Experimental Negotiating Agreement of 1973.

JOB SECURITY

Productivity and Job Security: Case Studies of Continuing Education for Engineers, Technicians, and Managers. 1978. GPO #052-003-00529-8, $1.90.

Three case studies involving IBM, Xerox, and the State of Pennsylvania. Traces the experiences of workers who undergo continuing education and training related to the jobs they do or are likely to do. Addresses problems of skill "obsolescence" and the costs extracted in both human and economic terms.

Productivity and Job Security: Attrition--Benefits and Problems. 1977. GPO #052-003-00435-6.

Three case studies on job security as a prerequisite to gaining employee cooperation when innovations for productivity increases are introduced. Cases include the attrition clause at the New York Times Company, involving the New York Typographical Union No. 6; craft unification through labor-management cooperation in the Alcoa, Tennessee, facility of the Aluminum Company of America, with the United Steelworkers of America, Local 309; and the agreement between Huntington Alloys, Inc. and Local 40 of the United Steelworkers of America to replace an individual incentive system with a Scanlon-type companywide group incentive system.

Productivity and Job Security: Retraining to Adapt to Technological Change. 1977. GPO, no stock number, $1.40.

Five case studies on retraining as a means of protecting the job security of workers affected by technological change. Four of the studies deal with privately sponsored retraining; the fifth concerns retreaining in local government. Cases include a foundry; the Wickliffe Mill of Westvaco, a major manufacturer of paper and packaging, with the United Paperworkers International Union; the program of the Chicago Graphic Arts Institute, a joint employer-union operated training institution; the AIRCO Technical Institute of Baltimore welders program; and the training program for housing inspectors in Detroit and other cities.

QUALITY OF WORKING LIFE

Alternatives in the World of Work. 1976. Available from GPO.

Highlights from Senate hearings and a national conference on organizing work to improve the quality of working life and productivity. The hearings were titled Changing Patterns of Work in America, 1976. The conference was called Implementing Alternative Work Patterns: Some Public and Private Sector Experiences with Flexible Working Hours and Part-Time Employment.

APPENDIX C. STUDIES, REPORTS, AND ARTICLES PREPARED FOR THE CENTER

STUDIES AND REPORTS

PUBLIC SECTOR

Descriptive Information on Selective Fire Indicators. 1978. Prepared by the Denver Regional Council of Governments.

Descriptive Information on Selective Police Indicators. 1978. Prepared by the Denver Regional Council of Governments.

Improving Productivity and Quality of Worklife in the Public Sector: Pioneering Initiatives in Labor-Management Cooperation, A Second Report on "Project Network." 1978. Prepared by the Management and Behavioral Science Center, The Wharton School, University of Pennsylvania.

Keeping Your Automotive Fleet on the Move, for Government Managers and Elected Officials, A Guide to Assessing Fleet Management and Maintenance Performance. 1978. Prepared by John S. Thomas, National Center for Productivity and Quality of Working Life.

Marketing: A Creative Approach to Citizen Participation in Government, A Report by the Public Sector Committee of the National Center for Productivity and Quality of Working Life. 1977.

A National Policy for Productivity Improvement in State and Local Governments, A Statement by the Public Sector Committee of the National Center for Productivity and Quality of Working Life. 1976.

Performance Measurement for North Carolina Communities, Volume One, Fire Protection. 1978. Prepared by the Research Triangle Institute and the N.C. Department of Natural Resources and Community Development--Community Assistance Division.

Performance Measurement for North Carolina Communities, Volume Two, Criminal Justice. 1978. Prepared by the Research Triangle Institute and the N.C. Department of Natural Resources and Community Development--Community Assistance Division.

Note: Studies and reports are available from NTIS (U.S. Department of Commerce National Technical Information Center)

Performance Measurement for North Carolina Communities, Volume Three, Street Maintenance. 1978. Prepared by the Research Triangle Institute and the N.C. Department of Natural Resources and Community Development--Community Assistance Division.

Performance Measurement for North Carolina Communities, Volume Four, Solid Waste Collection. 1978. Prepared by the Research Triangle Institute and the N.C. Department of Natural Resources and Community Development--Community Assistance Division.

Performance Workshops on Fire, Police, Sanitation, Roadways, Child Health Services. 1978. Prepared by the Council on Municipal Performance.

Problems of State and Local Government Productivity Improvement and the Federal Assistance Programs. 1977. Prepared by the National Center for Productivity and Quality of Working Life.

Processed Data on Management Indicators. 1978. Prepared by the Denver Regional Council of Governments.

Productive Public Management. 1976. Prepared by Chauncey Bell and Associates, Inc.

Productivity Improvement in Federal Field Inspection Services. 1978. Prepared by Productivity Management Associates, Inc.

Productivity Improvement in Federal Grant and Loan Administration Activities. 1978. Prepared by Productivity Management Associates, Inc.

Project Network, the First Network Conference. 1978. Prepared by the Management and Behavioral Science Center, The Wharton School, University of Pennsylvania.

Report on the Subcommittee on Public Employees of the Public Sector Committee of the National Center for Productivity and Quality of Working Life. 1976.

"You Wouldn't Believe What We Had To Go Through...," for Government Managers and Elected Officials, A Guide to Assessing Relationships with Citizens, Prototype Self-Assessment Guide. 1978. Prepared by Chauncey Bell and Associates, Inc.

INDUSTRY

Analysis of Critical Issues in the U.S. Shipbuilding Industry. 1978. Prepared by Pugh-Roberts Associates, Inc.

Construction Industry Productivity Forum/Workshop, Final Report. 1978. Prepared by Kellogg Corporation.

Cooperative Control Systems for Improving Construction Productivity. 1978. Prepared by Department of Civil Engineering, School of Engineering, Massachusetts Institute of Technology.

Data for Measuring Production, Employment and Productivity in the Men's Tailored Clothing Industry, Final Report. 1978. Prepared by Kramer Associates, Inc.

Incentives, Creative Leadership, and Capital Investment Increase Steel Foundry's Productivity. 1978. Prepared by the National Center for Productivity and Quality of Working Life.

Perceived Impact of Federal Laws and/or Regulations on Productivity Innovation in the Food Distribution Industry, A Fact Finding Study. 1978. Prepared by Donald J. Bowersox and Robert M. Monczka.

Study to Identify Attitudes of the Food Distribution Sector Relating to Distribution Research by the USDA. 1978. Prepared by Walter Frederick Friedman and Co., Inc.

Use of Automated Identification Technology by a Food Products Manufacturer and a Durables Distributor: The Standard Shipping Container Symbol and Grocery Distribution. 1978. Prepared by Distribution Codes, Inc.

CAPITAL

Preliminary Assessment of Capital Formation Issues (Aluminum, Chemicals, Electric Utilities, Paper and Allied Products, Steel). 1978. Prepared by Management Analysis Center, Inc.

TECHNOLOGY

A Cross Country Comparison of Public Policy and Technological Innovation: A Brief Overview. 1978. Prepared by Arthur Gerstenfeld, Department of Management, Worcester Polytechnic Institute.

Flexible Manufacturing Systems in the Federal Republic of Germany (BRD). 1977. Prepared by G. K. Hutchinson, Management Research Center, University of Wisconsin.

Flexible Manufacturing Systems in the German Democratic Republic (DDR). 1977. Prepared by G. K. Hutchinson, Management Research Center, University of Wisconsin.

Flexible Manufacturing Systems in Japan. 1977. Prepared by G. K. Hutchinson, Management Research Center, University of Wisconsin.

Formulating Public Policy to Improve Productivity Through Technological Innovation. 1977. Prepared by Robert W. House, Robert T. Nash, and Robert S. Goodrich, Technology and Public Policy Program, School of Engineering, Vanderbilt University.

Improving Industrial Productivity and Technological Capabilities: Needs, Problems and Suggested Policies. 1978. Prepared by Bela Gold, Research Program in Industrial Economics, Case Western Reserve University.

Industry-University Conference on Productivity Improvement, Provo, Utah. 1978. Prepared by Arthur Gould, Lehigh University.

Machinery Manufacturer Improves Productivity Through Group Technology. 1978. Prepared by the National Center for Productivity and Quality of Working Life.

Productivity Improvement Through Enhanced Technological Innovation, A Policy Statement by the National Center for Productivity and Quality of Life. 1978.

Report on NTH-Sintef, Trondheim, Norway, Site Visit. 1978. Prepared by G. K. Hutchinson, Management Research Center, University of Wisconsin.

A Review of Critical Factors Affecting Technological Innovation and Some Policy Implications. 1978. Prepared by Alok K. Chakrabarti and Associates.

Technological Innovation Position Paper. 1978. Prepared by James D. Hlavacek, Graduate School of Business Administration, Rutgers University.

The Use of Numerical Control Technology in Small Metalworking Plants, Final Report. 1978. Prepared by IIT Research Institute.

REGULATION

A Methodological Approach for Use in Assessing Impact of Government Regulation of the Steel Industry. 1977. Prepared by Policy Models, Inc.

Proceedings...National Conference on Regulatory Reform. 1976. Prepared by the Center for Policy Process and the National Center for Productivity and Quality of Working Life.

Reducing Unemployment Through Private-Public Enterprise Creation. 1978. Prepared by the National Center for Productivity and Quality of Working Life.

MANAGEMENT AND EDUCATION

All The Government We Pay For. 1977. Prepared by Chauncey Bell and Associates, Inc.

Productivity for Business: An Instructional Program, Evaluation and Summary Report. 1978. Prepared by Mary Ann Sadlo, Niagara Comunity College.

LABOR-MANAGEMENT AND QUALITY OF WORKING LIFE

Institutional Views on the Quality of Working Life. 1977. Prepared by Neal Q. Herrick.

Issues and Trends in Income and Employment Security. 1978. Prepared by Clint Bourdon, Harvard Business School.

Labor-Management Programs in the Construction Industry. 1978. Prepared by the National Center for Productivity and Quality of Working Life.

Report on Union Issues and the Quality of Working Life. 1978. Prepared by the Center for Quality of Working Life, Institute of Industrial Relations, University of California, Los Angeles.

Symposium on "Work In America: The Decade Ahead." 1978. Cosponsored by Work in America Institute, Inc. and the National Center for Productivity and Quality of Working Life.

CENTER-SPONSORED PUBLICATIONS

Enhancing Productivity in the Public Sector: A Primer for Citizen Interest Groups. John M. Hemphill, Jr., Boise Urban Observatory.

Guide to Productivity Improvement Projects. After three years of Center funding, the International City Management Association now publishes the Guide on a self-supporting, subscription basis.

"Improving Productivity for Better Service Delivery: A View from the Council Chamber." Management Information Service Report. June 1976. International City Management Association.

New Developments in Productivity Measurement. Forthcoming in 1978. National Bureau of Economic Research.

Practical Management for Productivity. John R. Hinrichs. Forthcoming in 1978. Work in America Institute, Inc.

Productivity in Local Government. Frederick O'R. Hayes. With support from the Ford Foundation. 1977. Lexington Press.

Public Productivity Review. 1976. Bibliography on public sector productivity compiled with help of Center staff. Center for Productive Public Management, John Jay College of Criminal Justice.

Municipal Innovations 9, "The Municipal Price Index." May 1976. Management Information Service, International City Management Association.

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Kimzey, Charles H. and C. A. Anderson. "Engineering Education's Responsibility for Improving Productivity." Engineering Education. November 1978.

Kuper, George H. "Labor-Management Councils: No One Loses." Defense Management Journal. April 1977.

__________ "Productivity: Washington Update 1977." Industrial Engineering. September 1977.

__________ "The Quality of Working Life." Part of "A Salute to American Workers." Enterprise. September 1977. National Association of Manufacturers.

__________ "Gap Closing on U.S. Productivity Lead Among Nations." Professional Engineering. November 1977.

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Pascale, Richard Tenner. "Zen and the Art of Management." Harvard Business Review. March-April 1978.

Thomas, John S. "Demand Analysis: A Powerful Productivity Improvement Technique." Public Productivity Review. Spring 1978. Center for Productive Public Management, John Jay College of Criminal Justice.

__________ "Government Accountability--For What?" Public Productivity Review. December 1975. Center for Productive Public Management, John Jay College of Criminal Justice.

Weinberg, Edgar. "Labor-Management Cooperation: A Report on Recent Initiatives." April 1976. Monthly Labor Review. U.S. Department of Labor.

__________ "The Federal Role in Improving Productivity." Professional Engineer. April 1977.

______________ "Meeting the Productivity Challenge" (working title). Spectrum. Forthcoming 1978. Institute of Electrical and Electronics Engineers.

Zager, Robert. "Managing Guaranteed Employment." Harvard Business Review. May-June 1978.

APPENDIX D. BOARD OF DIRECTORS, FORMAL COMMITTEES, AND PANELS

BOARD OF DIRECTORS*

Nelson A. Rockefeller, Chairman
Vice President of the United States

I. W. Abel
President, United Steelworkers of America

Donald C. Burnham
Director-Officer, Westinghouse Electric Corporation

Berkeley G. Burrell
President, National Business League

Edward E. Carlson
Chairman and Chief Executive Officer, UAL, Inc

C. L. Dennis
International President, Brotherhood of Railway, Airline, Steamship Clerks, Freight Handlers, Express and Station Employees

John T. Dunlop
Professor, Harvard Business School

Daniel J. Evans
Governor of Washington

Frank E. Fitzsimmons
President, International Brotherhood of Teamsters

Gaylord Freeman
Honorary Chairman, First National Bank of Chicago

Robert A. Georgine
President, Building and Construction Trades, AFL-CIO

Andrew E. Gibson
President, Maher Terminals

James E. Holshouser, Jr.
Governor of North Carolina

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* Titles and affiliations are as of January 20, 1977, when the Board of Directors resigned in accordance with Title II, Sec. 202(b)(1)(a) of Public Law 94-136.

BOARD OF DIRECTORS (continued)

Wayne L. Horvitz
Chairman, Joint Labor/Management Committee of the Retail Food Industry

J. Lane Kirkland
Secretary-Treasurer, AFL-CIO

R. Heath Larry
Vice Chairman of the Board, United States Steel Corporation

Bess Myerson
Syndicated Columnist and Consumer Advocate

Elliot L. Richardson
Secretary of Commerce

Herbert S. Richey
President and Chief Executive Officer, Valley Camp Coal Company, and Chairman, United States Chamber of Commerce

James F. Scearce
Director, Federal Mediation and Conciliation Service

L. William Seidman
Assistant to the President for Economic Affairs

William E. Simon
Secretary of the Treasury

William J. Usery, Jr.
Secretary of Labor

George H. Kuper
Executive Director, National Center for Productivity and Quality of Working Life

STEERING COMMITTEE OF THE CAPITAL AND TECHNOLOGY INDUSTRY - EDUCATION PROJECT

Donald C. Burnham, Chairman
Director-Officer, Westinghouse Electric Corporation

Professor Del K. Allen
Supervisor, Computer Aided Manufacturing Lab, Brigham Young University

Professor Clifton A. Anderson, P.E.
Emeritus Head, Department of Industrial Engineering
North Carolina State University

STEERING COMMITTEE OF THE CAPITAL AND TECHNOLOGY INDUSTRY - EDUCATION PROJECT (continued)

O. J. (Jack) Anderson
General Manager, Wilson Concepts, Inc.

H. Ford Dickie
(Retired) Staff Executive, General Electric Corporation

Professor Robert B. Gaither
Chairman, Mechanical Engineering Department, University of Florida

Professor Donald D. Glower
Dean, College of Engineering, Ohio State University

Professor A. F. Gould, P.E.
Associate Dean of Engineering
College of Engineering and Physical Sciences, Lehigh University

Dale B. Hartman
Director, Manufacturing Technology, Hughes Aircraft Company

Alvin P. Lehnerd
Vice President, New Products R&D, Black & Decker Manufacturing Company

C. H. (Pete) Link
Executive Secretary and General Manager
Computer Aided Manufacturing International, Inc.

Carl Meacham
Special Assistant to the Commissioner, Office of Education

Edward E. Miller
Senior Staff Engineer, Corporate Numerical Control Appliance
Western Electric Company, Inc.

Professor Charles D. Nash
Chairman, Mechanical Engineering, University of Rhode Island

Professor B. W. Niebel, P.E.
Head, Department of Industrial and Management Systems Engineering
Pennsylvania State University

Professor James L. Riggs
Department Head, Industrial and General Engineering
Oregon State University

Professor Byron W. Saunders
Dean of the Faculty
School of Operating Research and Industrial Engineering
Cornell University

STEERING COMMITTEE OF THE CAPITAL AND TECHNOLOGY INDUSTRY - EDUCATION PROJECT (continued)

Professor William A. Smith, Jr.
Department Head, Industrial Engineering
North Carolina State University

Thomas H. Spencer
Manager, Manufacturing and Materials Development
Caterpillar Tractor Company

Professor Richard E. Thomas
Associate Dean of Engineering, Texas A&M University

AIRLINE PRODUCTIVITY TASK FORCE

George C. Eads, Cochairman
Executive Director, National Commission on Supplies and Shortages

Richard J. Ferris, Cochairman
President, United Airlines, Inc.

C. L. Dennis
President, Brotherhood of Railway, Airline, Steamship Clerks, Freight Handlers, Express and Station Employees

Jeff Cochrane
Acting Deputy Administrator, Federal Aviation Administration

A. L. Feldman
President, Frontier Airlines

Arthur F. Keely
President and Chief Executive Officer, Western Air Lines

John R. Meyer
1907 Professor in Transportation, Logistics and Distribution
Harvard Business School

Captain John J. O'Donnell
President, Air Line Pilots Association

John Peterpaul
General Vice President, International Association of Machinists

John E. Steiner
Vice President, Technology and New Program Development
Boeing Company

PUBLIC SECTOR COMMITTEE*

Daniel J. Evans, Chairman
Governor of the State of Washington

Wayne Anderson
Executive Director
Advisory Commission on Intergovernmental Relations

Thomas Bradley
Mayor of Los Angeles (California)

Ruth Clusen
President, League of Women Voters

John D. R. Cole
Director, Bureau of Personnel Management Evaluation
U.S. Civil Service Commission

James E. Holshouser
Governor of the State of North Carolina

Mark Keane
Executive Director, International City Management Association

Winfield M. Keily, Jr.
County Executive, Prince Georges County, Maryland

James E. Kunde
Director of Urban Affairs, Kettering Foundation

Phyllis Lamphere
Seattle City Councilwoman (Washington)

Patrick J. Lucey
Governor of the State of Wisconsin

Marjorie Lynch**
Undersecretary
U.S. Department of Health, Education, and Welfare

James F. Marshall
Executive Director, Assembly of Governmental Employees

William H. McClennan
President, Public Employees Department, AFL-CIO

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* Titles and affiliations are as of January 20, 1977.
** Deceased.

PUBLIC SECTOR COMMITTEE (continued)

Thomas Moody
Mayor of Columbus (Ohio)

Thomas Morris
Assistant Secretary for Administrative Services
Florida Department of Health and Rehabilitative Services

Chester Newland
Director, Federal Executive Institute

Jean Packard
Community Development Center, National Association of Counties

John B. Rhinelander
Undersecretary, Department of Housing and Urban Development

Bernard Rosen
Professor, American University
Former Executive Director, U.S. Civil Service Commission

Elmer Staats
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APPENDIX E. SOURCES AND USES OF FUNDS, FY 1976-78

SOURCES

	FY 1976	FY 1977	FY 1978
Appropriation	$2,500,000	$2,750,000	$2,900,000
Interagency[1]	204,600	535,083	53,000
DOT		28,000	
HEW		275,000	
HUD		165,983	
Air Force		66,100	53,000
TOTAL	$2,704,600	$3,285,083	$2,953,000

USES

	ACTUAL FY 1976	ACTUAL FY 1977	ESTIMATE FY 1978
Human Resources	766,252	867,514	525,044
Capital & Technology	126,888	235,724	139,556
Government Relations	161,602	215,230	178,732
Public Sector/Federal Government	679,761	586,996	427,572
Private Sector	367,948	431,048	337,294
Airlines & Other		38,222[2]	47,445[2]
Construction		100,378[2]	107,555[2]
Food Distribution		244,032[2]	131,243[2]
Men's Apparel		48,452[2]	51,051[2]
Communication	297,212	366,860	389,073
Administration	226,345	197,357	350,455
Policy		335,713	565,831
Total	$2,626,008	$3,236,442	$2,913,557

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[1] Center activities are funded primarily by direct appropriation. In addition, other Federal agencies are able to take advantage of the experience and expertise reflected in the Center's programmatic activities by by these transfers.

[2] Detail of Private Sector Total

APPENDIX F. PRODUCTIVITY IMPROVEMENT ACTIVITIES AND PROJECTS OF THE FEDERAL GOVERNMENT

Previous Center Annual Reports have surveyed in some detail Federal activities which had productivity improvement as a direct, if not primary, intention. As a basis for analysis, in 1976 the Center surveyed 50 Federal agencies and found $933 million was obligated in that fiscal year to projects which related specifically to productivity growth. The Center's 1977 Annual Report focused on a representative sample of productivity improvement projects of intrinsic interest.

The two previous reports revealed that of the monies the Government devotes to productivity improvement activities, roughly 85 percent goes to civilian technology, about 9 percent to management and organization, and slightly less than 5 percent to human resources and labor-management relations.

This appendix of the Center's final report reviews very briefly each of several categories of Federal productivity improvement activities, more fully discusses support of technology development for the private sector, and looks into to two high leverage programs which deal with Government support of private innovation and technology transfer.

Measuring and Analyzing Productivity

Although productivity is usually measured by output per employee hour, output is actually produced by a complex mix of inputs: labor, capital, technology, and management. Devising ways to improve productivity depends heavily on measuring and understanding the interrelated contributions of these inputs to productivity.

The Bureau of Labor Statistics (BLS) carries out a program to measure and analyze the productivity of the private business sector and individual industries; also the Federal Government. It also researches methods for improving the measurement and analysis of productivity.

During FY 76 through 78, the National Science Foundation (NSF) and the Departments of Commerce, Transportation, and Agriculture supported projects which dealt with: productivity indices and analyses; productivity measurement seminars and reports; impacts of public policies on productivity; and impacts of highway freight loading practices on productivity.

In FY 1979, a reorganization of NSF eliminated the productivity measurement research program, except for completing those studies in progress.

Public Sector Productivity Improvement

Many of the measurements and findings of Federal productivity improvement programs have a direct application to corresponding functions at the State and local level. In addition, the application of both innovative hardware and managerial practices to State and local government functions has been aided by the NSF's Research Applied to National Needs (RANN) activities. These activities included projects to improve productivity in solid waste collection and disposal, arbitration of labor disputes, cable television utilization, video communication applications, fire-fighting equipment selection, and court procedures.

In FY 1979, these intergovernmental programs will continue at approximately the same level of funding ($5 million) under NSF's new Applied Science and Research Applications (ASRA) Directorate--the successor of RANN. This program is intended to facilitate the integration of science and technical resources into the operation of State and local governments by improving their understanding of science and technology-related issues and their application of science and technology solutions.

Human Resources, Labor-Management, and Quality of Working Life Activities

Within the Commerce Department, the Economic Development Administration continues its attention to innovative improvements of worklife. The level of support for these activities is declining slightly as private funding assumes these responsibilities.

The Department of Labor has ongoing activities concerned with labor-management cooperation, with human resources development, and with quality of working life demonstration projects.

The Federal Railroad Administration, with outside funding assistance, is examining job safety issues, as well as inefficiencies in terminal facilities and the many institutionalized barriers to railroad productivity improvement.

The National Institute of Mental Health in the Department of Health, Education, and Welfare has several ongoing projects concerned with the quality of working life. These include studies of occupational stress, relocation impacts, automation impacts, and new systems of work, among others.

The activities of the Federal Mediation and Conciliation Service fall into four categories: inplant labor-management committees, area or community labor-management committees, labor-management relationships by objectives, and labor relations training programs.

Management and Organization Improvement Activities

In FY 1976, approximately $90 million was expended to enhance productivity by improving management and organization in health care organizations, local governments, agriculture, manufacturing, and transportation. In general, these activities have been continued, although the restructuring of the Experimental Technology Incentives Program under the National Bureau of Standards has somewhat altered the emphasis on manufacturing management practices.

Technology Enhancement Activities

The Federal Government, both in its mission-oriented agencies and its research-oriented agencies, funds a substantial amount of R. & D. In FY 1976, major Federal funding of projects to improve civilian technology amounted to $786.3 million and included direct research in agriculture, forestry, fisheries, marine transportation, manufacturing, mining, energy, construction, services, and technology diffusion.

Two Federal programs are directed at learning more about the process of innovation and about how to improve it. These are, first, the Industrial Program Element of ASRA, and second, the Experimental Technologies Incentives Program (ETIP) of the Center for Field Methods of the National Bureau of Standards.

Both the ASRA program and the ETIP program are concerned with high leverage productivity enhancement activities. These agencies use research itself to discover how science and technology can produce innovation and thereby increase productivity in both the public and private sector.

Applied Science and Research Applications

RANN, the predecessor of the new ASRA Directorate, under which the Industrial Program Element now falls, had an overall FY 1978 budget of $57.9 million. The estimated FY 1979 budget is $73.9 million. Considerable reorganization and reallocation of funds has been accomplished, although the mission remains largely the same and all of the activities contribute to productivity through the development of new technologies.

ASRA's general mission is to foster R. & D. relevant to national problems by focusing on problem areas in which the NSF can make a unique contribution, by encouraging others to apply R. & D. to significant problems, by improving the efficiency and effectiveness of the innovation process in general, and by increasing the effectiveness of R. & D. application by others.

Five subactivities comprise the ASRA program:

1. The Problem Analysis subactivity identifies and analyzes major national problems which have a significant science and technology content and suggests how NSF, the Federal Government, and science and technology might solve them.
2. The Integrated Basic Research subactivity accelerates activities of basic research relevant to existing or emerging national problems.
3. The Applied Research subactivity provides a source of support for research not otherwise supported and enhances the scientific base of emerging technologies.
4. The Problem-Focused Research Applications subactivity focuses on research and development activity on selected problems which NSF can make a unique contribution to solving.
5. The Intergovernmental Science and R. & D. Incentives subactivity encourages the use of science and technology in State and local governmental policymaking, and program planning and execution; it also develops, tests, and evaluates incentives the Federal Government could use to stimulate private sector development of needed technology.

The Experimental Technology Incentives Program

ETIP was established in 1972 to discover how the Government might improve the environment for technological change in both Government and industry in order to enhance productivity. The program was funded with $3.1 million in FY 1977 and $3.1 million in FY 1978; in FY 1979, the figure has reached $3.2 million.

ETIP supervises experiments which assess the effects of innovation in the private sector. Currently, the program is sponsoring projects concerned with procurement policy, regulatory policy, civilian R. & D. policy, and economic assistance policy.

--ETIP's procurement policy research is directed toward using innovation and productivity. In its research on procurement policy, ETIP has concentrated on innovations in four major areas: life cycle costing, performance purchasing, prototype purchasing, and market aggregation at the State and local level.

Studies suggest that using life cycle costing criteria in Government procurement of selected products improves the quality of those products and that design improvements often are transferred to corresponding commercial products. In contrast, ETIP performance purchasing experiments seem to indicate that consumer preference successfully resists Government-generated product innovation.

In the area of prototype purchasing, there is evidence that the prospect of large Government orders alone is not sufficient to induce suppliers to produce small quantities of state-of-the-art products to Government specifications. Attempts to aggregate State and local government markets as a means of inducing innovation have thus far defied successful accomplishment.

--With regard to regulatory policy, ETIP has produced improved analytical techniques which materially simplify utility rate structure formulation. Studies in the regulatory area also suggest that changes in regulatory practices which enhance innovation in one industry may not be applicable to other industries.

--In the civilian R. & D. area, ETIP analysis shows that the successful commercialization of Government-funded development can be substantially enhanced if all potential stakeholders are involved in the market analysis from the beginning.

Additional ETIP research indicates that research consortia of interested parties are likely to be more effective in solving problems than those directed by single research interests such as universities. ETIP research has also verified that sound economic and engineering information encourages investment in projects of high payoff potential and that minimized technological risk is essential in capital-intensive ventures.

--An ETIP examination of Federal economic assistance policy revealed that the mix of relationships among essential factors involved in capital formation for technological innovation is much more complex than commonly believed.

ETIP currently is sponsoring 15 projects concerned with procurement policy; 10 concerned with regulatory policy; 6 involving economic assistance policy; and 2 involving civilian research and development activities.

Under the Assistant Secretary of Commerce for Science and Technology, ETIP is furnishing staff support to the Presidential Task Force for Domestic Policy Review on Industrial Innovation. This ad hoc organization is chaired by the Secretary of Commerce, and it has as members the Secretary of Defense, the Secretary of the Treasury, the Director of the Office of Management and Budget, the President's Science Adviser, the Chairman of the Council of Economic Advisors, and the Counsel to the President for Domestic Affairs. ETIP also has been assigned the responsibility for developing implementation and evaluation plans for the options the Task Force suggests to the President.

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